DEPARTMENT OF THE INTERIOR

REPORT

OF THE

CHIEF ASTRONOMER

FOR THE

YEAR ENDING MARCH 31

1911

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REPORT OF THE CHIEF ASTRONOMER AND INTERNATIONAL BOUNDARY COMMISSIONER.

Department of the Interior,
Dominion Astronomical Observatory,
Ottawa, Canada, May 1, 1911.

W. W. Cory, Esq., C.M.G.,
Deputy Minister of the Interior,
Ottawa.

Sir,—I have the honour to present the report of the Astronomical Branch of the Department of the Interior for the year ending 31st March, 1911.

The correspondence in the twelve months was:—

Letters received	2,190
Letters sent	3,365
Accounts examined	864

A statement of the work of the photographic division appears as Appendix No. 5.

The library contains 3,839 bound books and some 410 bound pamphlets. These are entered in a card catalogue under author and title. A further classification by subject was contemplated, but has been postponed, as, especially in the case of volumes of transactions of societies, collected works, etc., it calls for a great number of entries and cross references, on account of the diversity of the subjects treated. For lack of time, the librarian, who has other duties to perform, has been unable to make this classification. Sixty scientific periodicals are procured by subscription, and the number of observatories, societies, etc. (principally astronomical and meteorological), from which regular publications are received, is over 90. The bookbinder who has been employed here for some years numbering bound volumes for the library and preparing periodicals, unbound reports, etc., for binding at the Printing Bureau, has been provided with machinery and appliances, so that the binding may be done in the building. Since the bindery has been fully equipped (in February last) some 300 volumes have been bound; there are still 500 volumes or more awaiting binding.

The mechanicians have been kept busy with repairs and minor alterations to field and observatory instruments. No construction of special importance has been undertaken.

Fourteen meetings of the Ottawa Centre of the Royal Astronomical Society of Canada have been held, beginning in October. These meetings are fortnightly, alternately afternoon meetings in the Observatory and evening meetings usually held in a hall in the city. The number stated includes the annual meeting in December and a very enjoyable reception at the Observatory, for members of the society and their friends, on March 23rd.

The Saturday 'open evenings,' when the public is invited to visit the Observatory to look through the equatorial telescope, continue to be appreciated. There are also many day-time visitors, who, though they have not the opportunity of viewing the sky, are interested in examining the instruments and equipment.

The Observatory grounds have been terraced and sodded, with the exception of the northeastern corner, and the necessary roads laid out and prepared. Electric lights have been placed on the grounds and along the pathway leading to the electric railway. The residence of the Chief Astronomer was completed and was occupied by him at the end of July.

The foundation of the small building to house an instrument to carry the micrometer and stellar camera was laid last summer, but the superstructure was not proceeded with. The piers for the meridian marks have been erected, and the foundations laid of the buildings which are to cover them. Wooden sheds have been built over the piers to protect them from the weather, pending completion of the permanent structures. These piers are built for underground reference marks.

Mr. J. S. Plaskett attended the meeting of the Astronomical and Astrophysical Society of America, at Harvard, and that of the International Union for Co-operation in Solar Research at Mt. Wilson, Cal., last summer. At the former Mr. Plaskett was placed on three committees; those on the Solar Rotation, Radial Velocities, and the Classification of Spectra. At the meeting of the Solar Research Union, a share of the work of determining the solar rotation was allotted to this Observatory, associated with the observatories at Pulkowa, Edinburgh, Cambridge (England), Allegheny and Mt. Wilson. The invitation which Mr. Plaskett was authorized to convey to the Astronomical and Astrophysical Society to hold their annual meeting here next August has been accepted.

The apparatus for the solar work consists of a coelostat telescope, of 80 feet focus, and a Littrow grating spectrograph of 23 feet focus. Three different gratings have been thoroughly tested and the most suitable is now permanently mounted and is in regular use. A device consisting of two reflecting prisms has been applied, for bringing the opposite limbs of the sun on the slit together. One of the problems in regard to the solar rotation is whether the rotational velocity varies for different lines of the spectrum. An investigation of the errors which may thus arise has been undertaken. Experimenting has been done on the kind of plate that should be used, the development, etc., for the regions of the spectrum which are to be investigated, λ 5500 to λ 5700 and λ 4220 to λ 4280. The work of obtaining and measuring plates for the solar rotation is under way.

Four orbits of spectroscopic binary stars have been completed, η Camelopardalis, ν Orionis, 93 Leonis and ϵ Ursae Minoris. Work on three or four others is nearing completion, and a good deal of preliminary observing and measuring has been done on several other binaries. The weather for observing has been unusually bad during the past year; the average number of spectra obtained monthly has been 65, as against 76 last year. Part of this decrease may be accounted for by the fact that fainter stars have been observed upon, requiring larger exposure time. The aperture of the telescope is relatively small, compared with the instruments used in many of the observatories engaged in this branch of astronomical work. A larger telescope is much to be desired.

The telescope has also been used in measuring the position angles and distances of visual double stars, and in observing occultations of stars by the moon.

Photographs were taken of Halley's Comet, when it was near the earth, with the Brashear Doublet and also with a large Zeiss Tessar wide-angle lens. The weather at this time was, however, extremely unfavourable.

The underground lenses and long focus collimating lenses for the meridian marks, with the necessary mountings, have been ordered.

Improvements have been made in the mounting of the microscopes of the transit-circle and in the illuminating apparatus. The ventilation of the room has been improved by using ventilating fans, but it is still found that the temperature within does not follow that of the air without in a satisfactory manner, and further improvements in ventilation are contemplated.

The system of controlled clocks and dials has worked satisfactorily. Two hundred and ninety-two dials are now in operation.

The Bosch photographic seismograph has been in constant operation throughout the year. To one of the pendulums, magnetic damping has been applied by means of a powerful horseshoe magnet, the other pendulum retaining the air damping. The magnetic damping reduces the effect of the microseisms, and allows the phases of the greater disturbances to be more surely identified. Earthquake bulletins are issued regularly, and are sent to other earthquake stations in exchange for their bulletins. Twenty-four bulletins have been issued during the year, giving records of 89 earthquakes, and have been distributed to 55 stations. No earthquakes occurring in Canada have been recorded.

To assist in distinguishing earthquakes not of seismic origin, a Fuess electric recording Anemograph has been installed. It records the direction, velocity and pressure of the wind in ink on paper moved by clock-work.

The longitude of the transit house at Winnipeg, on Fort Osborne barrack ground, which is intended to serve as a base for longitude determinations in the prairie provinces, was determined early last summer by telegraphic exchange of time with Ottawa, using one of the copper wires of the Canadian Pacific Railway Company's telegraph. The low resistance and self-inductance of this wire made it possible to dispense altogether with repeaters, thereby obviating the uncertainty which prevails in using them as to the speed of response of the relays to current passing in the two directions, and materially increasing the accuracy of the exchanges. The time of transmission was six one-hundredths of a second, indicating a velocity of nearly 22,000 miles per second, and was remarkably constant from night to night, throughout the series of exchanges.

The longitudes of eight other stations were determined, namely, Walsh, Coutts, and Pincher in Alberta; North Portal and Mortlach, Saskatchewan; Emerson, Manitoba; and Sault Ste. Marie and Windsor, in Ontario. The last two were determined by exchange of signals with Ottawa, the others by exchanges with Winnipeg. The latitudes of all the stations, including Winnipeg, were also determined.

The work of the Magnetic Survey comprised the determination of declination, inclination, horizontal intensity, and the diurnal variation of declination at forty-eight points along the Canadian Pacific Railway between Chapleau and Moosejaw, and at forty-four points in southern and southwestern Ontario. The average distance between points was twenty-five miles. Two observers were employed on this work.

The negotiations referred to in my last annual report in regard to the questions at issue in Passamaquoddy bay, culminated in a treaty which was signed at Washington on May 21st, and ratified on June 6th, 1910.

By this treaty the boundary line through the southern part of the bay is defined by seven bearings and distances, beginning at the point between Treat island and Friar Head referred to in Article I. of the Treaty of 1908, and terminating in the middle of Grand Manan channel.

The boundary line as thus defined passes to the east of Pope's Folly island, and through the dredged channel to the west of the Middle Grounds.

The commissioners have not yet undertaken the marking of this line, nor of any part of the line defined by the first article of the Treaty of 1908.

The operations under the second article of the same treaty were continued by Mr. A. J. Brabazon, D.L.S., on behalf of Canada, and Mr. J. E. McGrath for the United States. They comprised the placing of reference monuments on each side of the river St. Croix, from the terminal point of last season's operations near St. Stephen, to near the outlet of the lower lake, at Vanceboro, and the making of a triangulation to determine the positions of these monuments.

The work on the third section of the boundary line was carried on by a joint survey party under Mr. Geo. C. Rainboth, D.L.S., on behalf of Canada, and Mr. Jas. B. Baylor, of the United States Coast and Geodetic Survey, for the United States. The work consisted in the survey of the boundary line along the St. John river from last season's terminal point, near Edmundston, N.B., up the river to the mouth of St. Francis river, and up the latter river, the line being defined by reference to monuments placed on each side of the rivers. These monuments are connected by triangulation. The survey operations were terminated near the boundary line of Temiscouata county, Quebec.

It is with very great regret that I record here the death of Mr. Rainboth. He was taken ill in camp just at the time that he was ready to bring the season's work to a close. His desire to see personally to the arrangements necessary in this connection led him to delay placing himself under medical care until it was too late. He was finally brought by canoe to Edmundston, and then placed on the train with the hope of getting him safely home in Ottawa. He died on the train at Rivière-du-Loup. He was one of the best known surveyors in the Ottawa valley, where he had practised his profession from his youth. He had also made many surveys for the Department of the Interior in the Northwest. Since 1905, he was in charge of the fieldwork of the resurvey of the 'Ashburton Line,' that is, the boundary line from the St. Lawrence river to the source of the St. Croix.

The resurvey of the 49th parallel (section 6 of the Treaty of 1908) was carried on by a Canadian party under Mr. J. J. McArthur, D.L.S., for a distance of about 150 miles from a point a short distance west of North Portal, eastward along the southern boundary of the Provinces of Saskatchewan and Manitoba. An American party at the same time was engaged on the resurvey of the same line farther west.

Mr. Geo. White-Fraser, D.T.S., continued the work of defining the boundary line through the straits of Georgia and Fuca, by means of reference monuments on the shores. This work is done under the eighth article of the Treaty of 1908.

Two surveying parties were employed on the survey of the boundary of the Alaska Coast Strip (Treaty of 1903); one under Mr. N. J. Ogilvie, D.L.S., in the Lynn Canal region, the other under Mr. F. H. Mackie, D.L.S., at the head of Portland canal.

The survey of the 141st meridian under the provisions of the Treaty of 1906 was continued by two large parties, one Canadian, one American, each divided into a number of sub-parties. The chiefs of the Canadian parties were Messrs. J. D. Craig, F. Lambart and A. G. Stewart, Dominion land surveyors.

The vista cutting and the placing of the final monuments were completed between White river and Yukon, also north of the latter about half-way to Porcupine river. On the latter section, the triangulation and topographical work were completed.

The survey of the line is therefore completed between the last mentioned point and the Natazhat range, south of White river. The projection of the meridian was carried to a point about ten miles north of Porcupine river.

Mr. D. H. Nelles, D.L.S., completed the precise levelling to a point on the 141st meridian. This line of levels is now complete from the summit of White Pass, along the White Pass Railway and the Dawson Road to Dawson, and thence west to the meridian. An American surveyor has completed the connection with tide-water by carrying a line of precise levels from Skagway, along the railway, to the summit.

On the Geodetic survey, two observers were employed, one in the province of Ontario, one in Quebec, measuring the angles of the primary triangles. Three reconnaissance parties, to select points for the extension of the triangulation, worked respectively in the western part of Ontario, to the south and east of Georgian bay, and on the British Columbia coast. A station-building party worked north and northwest of Toronto, erecting the towers for the triangulation, where these were required. Three parties were employed on the precise levelling. One of these parties worked in Ontario and one in Nova Scotia. The third, beginning at a bench-mark of the U.S. Coast and Geodetic Survey at Stephen, Minn., carried a line of levels north to Emerson, Man., and thence west along the railways, paralleling the international boundary.

Herewith are submitted, as appendices, reports by Dr. O. Klotz and Messrs. Plaskett, Stewart, and Macara, upon the work under their charge respectively; also a statement of the work done in the photographer's office.

I have the honour to be, sir,

Your obedient servant,

W. F. KING,
Chief Astronomer.

APPENDIX 1.

REPORT OF THE CHIEF ASTRONOMER, 1911.

SEISMOLOGY, TERRESTRIAL MAGNETISM AND GRAVITY

BY

OTTO KLOTZ, LL.D., F.R.A.S.

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ILLUSTRATIONS.

APPENDIX 1.

SEISMOLOGY, TERRESTRIAL MAGNETISM AND GRAVITY, BY OTTO KLOTZ, LL.D., F.R.A.S.

OTTAWA, ONT., April 1st, 1911.

W. F. KING, LL.D., C.M.G.,
Chief Astronomer,
Department of the Interior,
Ottawa.

SIR,—I have the honour to make the following report of the work carried out under my charge, during the fiscal year April 1, 1910, to March 31, 1911, and which is classified under the three headings—Seismology, Terrestrial Magnetism, and Gravity.

SEISMOLOGY.

Instruments.—The instruments which are in service are: two Bosch photographic seismographs, described in the report of 1906; a Callendar electric thermograph; a Shaw-Dines micro-barograph; a Fuess electric anemograph; besides wet and dry bulb thermometers. The new instrument acquired during the year is the anemograph.

The above instruments, outside of the seismographs, serve as auxiliary instruments for the interpretation of the seismograms, which show at times disturbances and movements that are not readily attributable to earthquakes. In this respect they have served their purpose well, as illustrated by the accompanying reproductions showing an intercomparison of micro-barogram, thermogram, anemogram and seismogram. (Figs. 5, 6 and 7.)

Beginning with the micro-barograph, which records rapid change of atmospheric pressure, but not the absolute pressure shown by a barometer, we find that almost simultaneous with the sudden increase of pressure, cold air pouring down from the higher regions, the thermograph shows a marked corresponding decrease of temperature. Again, this rapid increase of atmospheric pressure manifests itself by the pressure plate of the anemograph, and lastly the resulting steep gradients of the isobars induce strong winds, setting up oscillations of the observatory and ground, producing motion more or less irregular of the seismograph pier, as shown on the seismogram.

Owing to the proximity of our machine shop to the seismograph room, it has not been considered safe to draw conclusions as to the movement of the horizontal pendulum zero due to the diurnal heating of the earth by the sun, whereby the ground heaves or bulges following the course of the sun. It is expected that in the near future other quarters will be provided for the machine shop, and that the necessary delicate observations of earth movements due to heat may be made. As an example of the sensitiveness of the seismograph or horizontal pendulum, may be mentioned

an incident of last August, when a party of the Sons of England, in convention here, visited the Observatory. Their presence in the room above the seismograph room, which is in the basement, was duly recorded by the seismograph, in fact the time of their coming and going to and from the room was clearly shown. The 'impression' they left behind amounted to .097 seconds of arc, that is, they had compressed the earth equivalent to a gradient of one inch in thirty-three miles, or one in two million. Weighty Englishmen!

A brief description of the anemograph No. 1792, Fuess, Steglitz–Berlin, may be given. The accompanying illustrations will assist in understanding the working of the instrument. It records, by means of six pens, the direction, velocity and pressure of the wind, four pens being required for direction and one each for velocity and pressure.

Velocity.—Referring to Figs. 1, 2, 3, 4, *C* represents four copper hemispherical cups, each 20½ cm. in diameter and 80 cm. between centres of opposite cups. The cup-cross is secured to a steel rod by a nut, and has a ball-bearing. The cups move very freely, being set rotating with the slightest movement of the air. The steel rod *R* terminating in a point, rests in a small steel cup, and has a worm near its lower extremity which gears into the wheel *G*, having 144 teeth, so that 144 revolutions of the cups *C* are equivalent to one revolution of the wheel *G*. The electric record that is made of the velocity is the record of each revolution of the wheel *G*, and which is effected by an electric contact at *T*, closing the circuit momentarily thereby actuating through an electro-magnet the ratchet wheel *I* in the recording device, to be described later, and moving the paper forward a half-millimetre, which is recorded by the pen *O*, which also furnishes the time scale.

Direction.—The part of the apparatus *WPV* moves freely, being ball-bearing under the cap where the chain is seen. *V* is a copper vane, 58 cm. long, 30 cm. wide at the back and 18 cm. in front. The two plates forming the vane are 9 cm. apart in front and 29½ cm. at the back. *W* is simply a counter-weight. The motion or direction of *WPV* is communicated through the brass rod *E* to the two gear wheels *D*, the axis of the left-hand one terminating in a quadrantally-divided cylinder, upon which electric contact is made by a split copper brush, so that the latter may rest either wholly on one quadrant or on two adjoining ones. The quadrants represent respectively the directions N., E., S., W. When the brush rests only on one quadrant, one of the cardinal points will be recorded as the direction of the wind; if it rests on two then the direction of the wind will be shown as being either N.E., N.W., S.E., or S.W. In short, the apparatus records eight different wind directions, N., N.E., E., S.E., S., S.W., W., N.W. With reference to the electric recording it may be mentioned here that the circuit for direction is in circuit with that for velocity, so that direction is only recorded when the circuit is closed at the gear wheel *G*, hence the records for direction and velocity are simultaneous; while the one pen *O* records that gear wheel *G* has made another revolution, one or two of the direction pens *F* records the direction of the wind at that moment.

Pressure.—*P* represents the pressure plate and, of course, being attached to the vane frame, always faces the wind. It is 25½ cm. in diameter, and is attached to the system of levers terminating in the spring *S*, which presses against a plate. The motion in and out of the plate *P* is communicated to the rod *B*, which in turn moves the arm *A* (Fig. 2) making, successively, twelve electric contacts *H*, representing twelve different pressures from 0 to 7.52 pounds to the square foot. How these different pressures are recorded will be described under a description of the recording device.

In Fig. 2, *N* shows the connection for 20 wires. The mechanism of the anemometer is tightly closed in. The 20 wires are gathered into a lead-covered cable, not shown, which, in passing out of the lower part, is covered with a nut having packing so as to prevent moisture or snow from entering the lower case or compartment. The cable leads along the stone cornice of the Observatory and into the building to the recording apparatus.

The steel skeleton, made of 2-inch pipes (Fig. 3), supporting the anemometer, is 6 m. in height, and the cup-cross 2 m. above this, and 20 m. (66 ft.) above the ground. The skeleton is anchored in a heavy cement bed specially built in the corner of the Observatory roof.

In Fig. 4 is seen the connection of the wires of the cable to the lightning arrester *L*, to which also are connected the wires of the recorder and the wires *K* for the current of six volts supplied by a storage battery of three cells. The eight-day clock gives the time scale by means of the rod *U* carrying the pen *O*. This rod, with rack, rests on a pinion of the clock-work, and moves uniformly to the right about halfway across the paper. At each hour the minute hand at XII slightly raises the rod, when the weight within the damping cylinder *Z* draws it over to the left-hand edge of the paper. When the minute hand, tipped with a platinum point, disengages the rod *U* it also makes electric contact whereby the ratchet wheel *I* is moved one tooth, and the paper descends $\frac{1}{2}$ mm. The hour line drawn across the paper consists, therefore, of a series of steps each of $\frac{1}{2}$ mm., there being as many steps as the velocity gear wheel *G*, already described, has made revolutions during the hour, plus one step for each hour. Instead of counting the number of steps in an hour, a glass scale is provided, graduated to a hundred half-millimetres, with an extra half-millimetre at zero for the hour contact, which is not counted in with the velocity breaks or steps.

The direction of the wind is recorded by the four pens *F*, being in the order from the left—north, east, south and west. They are connected to the armatures of four electro-magnets seen to the left, so that when the circuit is closed one or two of the pens makes a jog in the respective line.

The recording of the pressure is done by an ingenious device. It has already been stated that the pressure arm *A* makes twelve different contacts, there being, therefore, twelve different circuits or currents therefor, represented by the twelve coils *Y* above and below the iron plate *X*, which acts as an armature. This iron plate, carrying a vertical rod, rests on a pivot, and is free to move thereon, *i.e.*, to be attracted to any corresponding pair of coils, so that the vertical rod describes, in going the rounds of all the contacts, a cone. This motion of the rod is communicated to the axis of a pinion which gears in the rack on the carriage *M* on which is supported the pen *J* for registering the pressure. The pressure is recorded for twelve definite pressures, the pen moving 3 mm. (6 half-mm.) for each pressure from zero pressure. The pressure record is thus represented by a to-and-fro movement of the carriage *M*, and this motion is recorded by the pen *J*. By comparing the length of the lines made by *J* with the table of constants, which I especially determined for this instrument, we obtain the pressure in pounds per square foot of the wind at any particular time.

Constants.—For velocity, we have the diameter of the cup-cross between centres of 80 cm. Hence pathway of one revolution is 251.33 cm. As the gear wheel *G* has 144 teeth, one revolution of the wheel is equivalent to 362 m. Taking for an approximation that the cup velocity is one-third that of the wind, we obtain the indicated velocity of the wind as 1.086 km. for one revolution of the gear wheel *G*, that is for each electric contact.

Professor Marvin's direct experiments for the relationship between cup and wind velocities with an anemometer whose cups were 4 inches in diameter and arms 13.44 inches, centre to centre of cups, gave the empirical formula:

$$*\log V = .509 + .9012 \log v$$

in which V is the true velocity of the wind, and v the velocity of the cups, the indicated velocity being $3\,v$. Although the dimensions of the Fuess cup-cross are considerably larger than those of the Marvin anemometer, yet the above formula is fairly applicable to the former, as deduced from comparison of indicated velocities with recorded pressures, the latter having been directly measured, as about to be explained.

Before the anemometer was mounted outside, tests were made on the pressure plate P. A slat was placed centrally over the plate; from it led two horizontal strings which passed over small brass pulleys, and then weights were successively attached to the connected strings. Beginning with zero and increasing by one pound up to twelve pounds, readings were taken of the position of the arm A, as it passed over the various contacts from 0 to 12. Each of the twelve small brass plates on which electric contact is made was subdivided by estimation to tenths when taking the readings of the arm A for the different weights. From a number of careful readings the following mean values were obtained:—

Actual measurements with weights over pulleys, pressing pressure plate.		Interpolated Values.	
Pounds	Readings on Arm.	Readings on Arm.	Pounds.
0	1·62	1·62	0
1	3·20	2·50	·56
2	4·66	3·50	1·21
3	5·95	4·50	1·89
4	7·17	5·50	2·65
5	8·03	6·50	3·45
6	8·74	7·50	4·38
7	9·32	8·50	5·66
8	9·91	9·50	7·30
9	10·42	10·50	9·14
10	10·98	11·50	11·12
11	11·45	12·50	13·68
12	11·88		

It was intended to have the adjustment of the spring S so that the centre of the first small brass plate, which would be equivalent to 1.50 in the above method of reading, should indicate zero pressure, but after adjustment it was found that zero pressure read 1.62, a matter of no consequence. It must be remembered that the pressure plate is $25\frac{1}{2}$ cm. in diameter, giving a surface of 79.16 square inches. Hence, if the wind were blowing against a square foot, in order to produce the same arm reading, which is the record we get on our anemogram, the pounds pressure represented would be $\frac{79.16}{144} = .55$, that shown by the actual pressure plate of $25\frac{1}{2}$ cm. diameter.

* Circular D, Instrument Room, Washington, 1893.

Applying the constant .55 to the last column of the preceding table, we obtain the pressure per square foot when the contact is centrally over the twelve small brass plates, and equivalent to the arm readings of 1.50 (1.62), 2.50 ...... to 12.50. On the anemogram, or pen record, it would be equivalent to scale readings 0 to 66 half-millimetres, there being, as already stated, a movement of the pen of 3 millimetres or 6 divisions of the half-millimetre scale for each successive electric contact.

Interpolating for the pressures thus obtained the indicated velocities, and from the latter the true velocities from the tables given in Marvin's paper, Circular D, referred to above, these latter are reproduced in Moore's 'Descriptive Meteorology,' 1910, as tables XXVII and XXVI respectively, we obtain the following table in which there is an interpolation for the mean between two successive contacts, or for every 3 half-millimetres:—

Pressure Table.

Glass Scale Reading	Pressure per sq. ft.	Indicated Velocity	True Velocity	Glass Scale Reading	Pressure per sq. ft.	Indicated Velocity	True Velocity
½ mm.	Pounds.	Miles.	Miles.	½ mm.	Pounds.	Miles.	Miles.
0	0	0	0	36	2·41	28·5	24·6
3	·15	6	6	39	2·76	30·7	26·3
6	·31	9	8·7	42	3·11	32·8	27·9
9	·49	11·7	11·0	45	3·56	35·3	29·8
12	·67	14·0	12·9	48	4·01	37·8	31·7
15	·85	16·0	14·6	51	4·52	40·3	33·6
18	1·04	17·9	16·1	54	5·03	42·8	35·4
21	1·25	19·9	17·7	57	5·57	45·3	37·3
24	1·46	21·7	19·2	60	6·12	47·8	39·1
27	1·68	23·4	20·5	63	6·82	50·7	41·3
30	1·90	25·0	21·8	66	7·52	53·5	43·4
33	2·15	26·7	23·2	..	....	....	....

Having constructed this table, a comparison became possible between the deduced true velocity from the formula for log V, based upon the actual revolution of the cups, and the deduced true velocity from the actual pressure recorded by the pressure plate. This comparison is not very simple or easy, especially for the higher velocities and pressures, as for these we seldom find them here continuous for any length of time, say an hour or hours. For such, it is necessary to take measurements for shorter intervals, for one or several revolutions of the velocity gear wheel G, as recorded on the time scale, and compare this with the offset on the pressure record opposite to it. For instance, on Oct. 1 there was a pretty high wind for some hours, fluctuating, however. Between 2 and 3 p.m. the maximum was reached, when, during an interval of about 4 minutes, the measurements for velocity gave an indicated velocity of 39 miles, while the measurement for pressure, 4.01 pounds to the square foot, gave an indicated velocity of 38 miles, a fair inter-agreement. Again, on that same day, the pressure for several hours kept pretty constant at .67 pounds, indicating by the above table a velocity of 14 miles, while the average velocity for that time was 16.5 miles, an agreement not so accordant as the preceding one. Reducing those indicated velocities to true velocities would not change the comparison of the two independently determined quantities.

The instrument has worked satisfactorily except on one or two occasions when glare ice (the freezing of rain in mild winter weather) prevented the free action of

the pressure plate. A change has been effected in the bearing of the anemometer rod, which rested in a steel cup. This latter serves now only as a guide, the weight being borne at a shoulder at the upper part of the rod on a ball-bearing.

It may be observed here that the standardizing of the large anemometers of the Imperial Meteorological Observatory at Potsdam, Germany, is done by means of a small anemometer which has been standardized at the Deutsche Seewarte, Hamburg, in the usual manner by mounting it on the extremity of a long arm which can be revolved at any given speed. The revolutions of both arm and anemometer are electrically recorded. The small anemometer is then set up in the proximity of the large one to be standardized, and from the records of both the constants of the latter are determined.

Earthquakes.

During the fiscal year there were recorded here 89 earthquakes of various degrees of intensity, as shown on the subjoined record. The most destructive, as far as human lives are concerned, were the earthquake at Cartago, in Costa Rica, on May 5, 1910, and the one of January 3-4, 1911, in Turkestan, Asiatic Russia, where many lives were lost. The distance to the epicentre of the former was 4,000 km. (2,500 miles), and to the latter, 9,800 km. (6,100 miles). It may be opportune here to refer to the method of the determination of the distance to an epicentre of a well-recorded quake, and a severe quake may be well recorded even if situate on the opposite side of the earth, but in such case the seat of disturbance must not be shallow, as was the case in the Massina destructive quake, but it must be deep-seated, say extending beyond 50 km. beneath the surface of the earth, so that it may obtain a thorough grip, so to speak, to give the earth a world-shaking.

The routine of a seismogram here is as follows:—Every morning at 10 a.m. a fresh photographic sheet is put upon the cylinder, the exposed one taken to the photographic room, developed and brought to my room, where it is examined. If an earthquake is recorded the diagram is analyzed into its constituent parts or phases. It is always gratifying if, during the quake, microseisms are absent. These are small pulsations of about 5 seconds period and are due to steep barometric gradients over the ocean, producing winds and consequent waves beating on the shores, setting up vibrations of the land, particularly if the surf pounds on and against rocky shores. On sand dunes it is less effective. We first look for the beginning of the quake, or first preliminary tremors, as is the technical term. As our seismograph (there are two) is a horizontal pendulum, and consequently records horizontal displacements of the motion of the ground, it is obvious that the more distant the quake the less effective will be the horizontal component of the longitudinal or compressional wave first arriving from the epicentre, the horizontal component disappearing completely at the antipodal point to the earthquake, where only the vertical component would be in evidence for that kind of wave, which is the one travelling with the greatest speed.

We minutely follow our zero line, which, in the absence of a disturbance, is a straight line, broken electrically by a short two-second interval every minute by our standard mean-time clock, and note the first deviation of the zero line, at times barely visible, although the motion is theoretically magnified 120 times. We measure along the respective minute, represented by 15 mm., the time of arrival of the first preliminary tremors, designated by *P*, and record it to the individual second. Generally the first indication of the arrival of a wave is followed within a second or so by a well-marked impulse or offset to the zero line.

We are next concerned with the finding of the second preliminary tremors *S*, produced by waves having transverse oscillations, like those of light,—distortional

waves. The horizontal components of these, for distant quakes, are generally better marked or recorded than those of the preceding or longitudinal waves, waves like those of sound. Having thus identified the arrival of these S waves, we have the data for determining the distance to the epicentre. However, we look for corroborative evidence, and continue our analysis of the seismogram. As explained in former reports, seismologists recognize in the energy of earthquakes three distinct forms of waves—the longitudinal wave, producing compression and dilatation; the transverse wave, producing distortion; and the surface wave. The first two travel through the earth, from the epicentre to any point on the surface, along the 'brachistochronic' line or curve, being the shortest time-line between the points, and is concave to the straight line joining the points, the curvature being dependent upon the constants of the material within the earth along its path, while the last travels along the surface.

As might be surmised, the velocity of the first two, as they dip into the earth to various depths with changing constants within certain limits, is variable, while for the surface waves the velocity is fairly constant, as established from our own records here of various quakes, and of the same quake using the records of widely separate stations.

Wiechert and Zöppritz compiled, a few years ago, the data of severe quakes whose geographical co-ordinates were well known, as well as the local time of occurrence. From these time-curves, improperly called by some, hodographs, were constructed the abscissae representing distance and the ordinates, time. From these, then, having $S-P$ from a seismogram, or the difference in arrival of the second and first preliminary tremors, the corresponding distance to produce the difference in time is found. Professor Zeissig has interpolated the distances to 10 km. intervals and published a table for $S-P$ to 12m. 56s. corresponding to a distance of 13,000 km. Although there is some room for improvement in the table, as the compilers well recognize, yet when the distances are not too great, say 7,000 km., the deduced distances for $S-P$ are in pretty good accord, say within about 50 km., with the actual distances obtained later from accounts of the earthquake in situ.

Having now obtained the distance, Δ, we look for corroboration. From our time-curve we have the time of propagation of either the first or second preliminary for that distance, *i. e.*, we find the time of local occurrence of the quake. Knowing the rate of propagation of the surface waves, which is approximately 200 km. per minute, we have immediately the time when they should make their appearance on the seismogram, and this we compare with what we actually find to corroborate our $S-P$ distance. Again, it is found that the longitudinal waves record themselves after having been once or even twice reflected. That is to say, such waves, striking midway between the epicentre and the respective recording station, are reflected, pursuing a similar course to their preceding one, and emerge at the station in a time equal to twice the time of propagation for half the distance Δ corresponding to $S-P$. The horizontal component of this reflected wave, if there has not been too much absorption owing to the longer course or path, often manifests itself more sharply owing to the smaller angle of emergence, calling the latter the angle made by the impulse with the surface of the earth, the horizontal component being a function of the cosine of this angle. Thus the comparison of the computed time of arrival of this reflected wave, $P\,R_1$, with the actually recorded time is another means of checking our original deduced Δ from $S-P$. We may proceed similarly for $P\,R_2$ for a wave twice reflected, that is, for a wave that divides the distance into three equal paths. This wave is, however, less often clearly definable. We may in some cases be able to identify reflected S waves. By the time the S waves arrive

there begins a medley of interferences that are not really distinguishable. By the time the surface, or long waves L, arrive, the field is generally pretty clear, the P and S waves having spent themselves. Unfortunately, the earthquake waves and pulsations do not accommodate themselves for ease of reading and interpretation of the seismogram. Probably in the less number of cases is the break-down or cataclysm one single effort, but a series of shocks sending out their waves, producing thereby a rather complicated record that taxes one's skill to the utmost in deciphering it.

The most important record is, of course, the accuracy of the time of arrival of the first waves. From the nature of our instrument, having photographic registration, and therefore free from the friction inherent to mechanical registration, so much in vogue on account of cheapness, we have been able to detect movements of the earth so slight that mechanical registration would not respond to them.

We have now shown how the distance, Δ, of an earthquake is found from a single seismogram. For earthquakes that occur in inhabited regions we can subsequently compare our deduced distance with the actual one. This gives a measure, on the one hand, of the accuracy of our reading of the seismogram, and on the other, of the accuracy of the above time-curves.

With world-shaking quakes we obtain sometimes a record of long waves that have travelled along the longer part of the great circle passing through the epicentre and station. In such case the maximum amplitudes of the waves by the shorter and longer paths give us a measure of the absorption. By absorption, we understand the absorption of energy per unit distance, per kilometre. Assuming that the periods of the two sets of waves are the same, for our amplitude depends on the magnification of the instrument, and the magnification in turn on the period of the wave and on the damping co-efficient, we may write the general expression for absorption in the form

$$E_\Delta = E_o e^{-k\Delta}$$

in which E_o = original energy.

E_Δ = energy at distance Δ from epicentre.

e = base of Naperian logarithms.

and k = co-efficient of absorption.

Hence the ratio of the energy at distance Δ to that at $40000-\Delta$, would be as $e^{-k\Delta}$ to $e^{-k(40000-\Delta)}$ or as 1 to $e^{-k(40000-2\Delta)}$.

The manifestation of the energy we have expressed in our seismogram by the maximum amplitude. The energy at different distances varies as the square of the amplitudes, hence we have

$$\left(\frac{a_{40000-2\Delta}}{a_\Delta}\right)^2 = e^{-k(40000-2\Delta)}$$

and, therefore,

$$k = \frac{2{\cdot}30}{40000-2\Delta}\, 2 \log \left(\frac{a_\Delta}{a_{40000-\Delta}}\right)$$

where 2.30 is the reciprocal of log e.

The distance, $40000-2\Delta$, is represented by the time interval between the M_R, M waves, that is, the times of arrival over the distances $40000-\Delta$, and over Δ. If we multiply this time interval by the rate of propagation or velocity, which we assume to be uniform, we obtain the desired distance. We may take the average

velocity of surface waves to be 200 km. per minute. Hence, if we express $M_R - M$ in minutes, our formula becomes

$$k = \frac{\cdot 023}{M_R - M} \log \left(\frac{a}{a_R}\right).$$

In general, the former expression for k is preferable, as we eliminate $M_R - M$, also the assumed velocity of the L waves to which M belongs.

It is found that for a_R its value does not vary appreciably within a fairly wide range of the time M_R, and furthermore, that its actual measure on the seismogram is small, very small, and difficult to express with much accuracy, the error of reading being large compared with the quantity to measure. However, admitting these uncertainties, yet it is found by different investigators, and from the records of different earthquakes, that the co-efficient of absorption appears to lie between .00015 and .00035.

Taking the seismogram here of the recent severe earthquake, January 3-4, 1911, in Turkestan, where we had a record of the M and M_R waves, the value of k is found to be .00032.

Having dealt with the interpretation of the seismogram, as far as Δ and k are concerned, we shall turn to the location of an earthquake, *i.e.*, of its epicentre. In my previous report it was shown how such location may be effected graphically by means of the stereographic projection; our data being the values of Δ for three stations, not too close together, and the geographical co-ordinates of the latter. This method has proved very satisfactory, and, for accuracy, quite in keeping with the accuracy of Δ. It goes without saying that careful plotting or drawing is essential for obtaining satisfactory results.

Instead of computing for every world-shaking earthquake the necessary values of d and r, required in our stereographic projection, the following tables* were computed, so that by simple inspection or interpolation for any distance Δ up to 13,000 km. the corresponding values of d and r are obtained. It will be remembered that d represents the distance from the Pole along the respective meridian line to the centre of the circle or arc, radius r, on which the epicentre lies. The values of d and r are computed from

$$d = \frac{\cos\varphi}{\sin\varphi + \cos\Delta},\ r = \frac{\sin\Delta}{\sin\varphi + \cos\Delta}.$$

We may give an example of the application of the above tables for locating an epicentre, taking the Turkestan earthquake already referred to. As stations, we take Strassburg, Pulkowa and Ottawa, using their published time records of P and S for obtaining Δ, Zeissig's tables. We thus have the following data:—

Strassburg	$\varphi = 48°\,35'$,	$\lambda = 7°\,40'E$,	$\Delta = 5300$ km. $= 47°\,42'$
Pulkowa	$\varphi = 59°\,46'$,	$\lambda = 30°\,20'E$,	$\Delta = 3690$ km. $= 33°\,13'$
Ottawa	$\varphi = 45°\,24'$,	$\lambda = 75°\,43'W$,	$\Delta = 9800$ km. $= 88°\,12'$

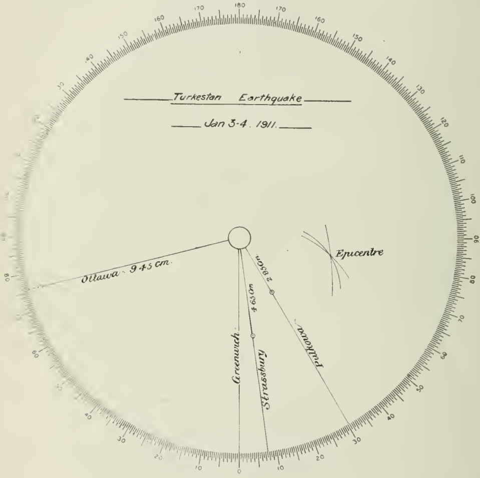
Interpolating from our above table we get for

Strassburg	$d = 4.65$,	$r = 5.20$
Pulkowa	$d = 2.95$,	$r = 3.16$
Ottawa	$d = 9.45$,	$r = 13.45$

in terms of radius $= 10$ cm.

* These tables will appear in the Publications of the Dominion Observatory as Vol I, No. 1.

In the accompanying figure we have the primitive circle on which the projection is made of 10 cm. radius. We proceed to draw the meridian lines for each station, being simply the longitude from Greenwich, or zero meridian. d is laid off from the Pole along the respective meridian, and gives the centre of the circle of which r is the radius. Laying off the three d's and describing the three arcs we find them to intersect, if not at a mathematical point, yet very close to each other.



Theoretically if the earthquake emanated from a point, and our Δ's were absolutely correct, then the intersection with careful drawing would practically represent a point for the epicentre. As a matter of fact, however, the earthquake or break-down is not a point, but more properly a plane, so that we can scarcely expect our intersections to have a common point, but instead to form a minute triangle, of which we take the centre of gravity as the most probable point of the greatest intensity of the seismic disturbance.

From the distance of the Pole to this point in our construction we obtain the latitude of the epicentre, for this distance is equal to tan $(45° - \frac{1}{2}\varphi_0)$, where φ_0 is the latitude of the epicentre. The longitude is read directly on our circle, simply

by drawing the meridian line from the Pole through the point or epicentre. In our diagram, the distance from the Pole is 4.28 cm., representing the tangent of $23°10'$, hence $\varphi_0 = 43°40'$, and the longitude we find to be $78° 20'E$. The epicentre of this quake has thus been found to be in

$$\varphi = 43° 40', \quad \lambda = 78° 20'E.$$

Prince Galitzin found, by his method, the geographical co-ordinates to be $\varphi = 43°14'$, $\lambda = 78° 24'$, a very close agreement.

The epicentre has thus been found in a simple and expeditious manner, and with an accuracy quite in keeping with our data.

With a larger scale, say of 20 cm. for radius of our circle, we can attain somewhat greater accuracy. However, I find that with careful plotting that the 10 cm. radius serves the purpose quite well. To force the accuracy of our result within a few kilometres when our data lack such, is like cracking walnuts with a sledge-hammer. With the present conditions, I think we are doing pretty well if we feel fairly sure of our half degree in the location of our epicentre. As the absolute time at some, perhaps many, stations is not very accurately known, thereby affecting the time record, it will be noted that in the above method the absolute time does not enter, but only the time difference $S-P$, in short, the method is independent of the time correction. However, for other reasons, it is highly desirable that all stations have their time accurate within a second.

From our stereographic projection we may also deduce the azimuth of the epicentre. The azimuth is the angle at the station between the meridian and the tangent to the great circle passing through the station and epicentre. For describing this circle we have three points, the station, its nadir, and the epicentre. The station is projected on the meridian line at the distance of $\tan\ (45° - \frac{1}{2}\varphi)$, and the nadir at, and in the opposite direction, of $\cot\ (45° - \frac{1}{2}\varphi)$. We have thus three points cut by the circle. The three points form a triangle in the circle, and the angle at the epicentre, from simple geometrical relations, is equal to $180° - A$, where A is the required azimuth.

In the figure, the points for tan and cot $(45° - \frac{1}{2}\varphi)$ for the three stations, and the connecting lines to the epicentre, are not drawn, to avoid confusion.

In the original drawing we find graphically for Ottawa $A = 18°$, and solving trigonometrically the spherical triangle, Pole—station—epicentre, we obtain $A = 18° 27'$. Similarly, for Strassburg we find graphically $A = 111° 30'$, computed, $A = 112°05'$; and for Pulkowa graphically $A = 97°45'$, computed, $A = 97° 28'$. Prince Galitzin obtains the mean, from the maximum amplitudes at the beginning of the first preliminary tremors, $A = 97°57'$.

The above azimuths are reckoned from north through east.

In some other methods the azimuth enters into the determination of the epicentre, which is not the case in the method described. It will now be shown briefly how the stereographic projection adapts itself also for plotting with azimuth and distance. We have given Δ and A. On the meridian line of any station we have three known points, their distances from the Pole being respectively

$$\frac{\cos\varphi}{\sin\varphi + \cos\Delta},\ \tan\ (45° - \tfrac{1}{2}\varphi), \text{ and } \cot\ (45° - \tfrac{1}{2}\varphi),$$

as already explained; furthermore, the angle A at the station, which gives the tangent to the circle through the station and its nadir. Hence the circle can be described having given a chord (station to its nadir) and tangent.

Finally we draw an arc with radius $r = \frac{\sin \Delta}{\sin \varphi + \cos \Delta}$ at the distance d from the centre.

Where this arc cuts the above circle is the epicentre, whose geographical co-ordinates are then determined, as already described.

The stereographic projection for the location of the epicentre of a world-shaking earthquake has already been adopted by quite a number of stations on account of its simplicity.

Microseisms.

These pulsations that are world wide, and are recorded by modern instruments at every earthquake station, have been dealt with somewhat fully in former reports. Although their complete analysis has not yet been effected by any one, yet their cause, with the additional data as obtained here, is, as was deduced from previous years' records, due to the presence of a barometric 'Low' with steep gradients on the ocean near the coast, thereby setting up winds, followed by waves beating on the rocky shores of Eastern Canada and the New England States. If these shores were sandy beaches or lined with sand dunes throughout, the effect of the waves or surf would be materially lessened in producing these microseisms. The period of these pulsations does not vary very much, lying generally between 4 and 6 seconds. The steeper the gradients of the 'Low' the greater will be the amplitudes of the oscillations shown on the seismogram, while the period generally increases somewhat, but not by any means in the proportion of the amplitudes. Whether the periods synchronize exactly with the surf has not yet been established. The writer has on several occasions, during stormy weather on a trip across the Atlantic, counted the period of the waves as manifested by the pitching and dipping of the steamer, and found the period to be 8, 9, or 10 to the minute, *i. e.*, 6 to 7½ seconds.

At the meeting of the International Seismological Association at Zermatt, in September, 1909, a special committee on microseisms was constituted, of which the writer is a member, to have an instrument designed, constructed and mounted at the sea-shore for counting the waves, that is, of determining their period, so that the relationship between the latter and microseisms may be studied. The instrument is now in course of construction by the Cambridge Scientific Instrument Company, so that results may be looked forward to during the present year. One thing has been definitely established here, and that is, that microseisms have their origin on the ocean. One cannot but marvel that at a station hundreds of miles from the nearest sea-shore, as Ottawa is, the earth should be set in vibration, and such vibration be recorded, in consequence of an agitated sea.

In the accompanying Fig. 8, the prevalence of microseisms during the year 1910 is graphically shown. The daily record has been grouped by five days. The mean of the maximum amplitudes for every five days has been taken, or six groups for each month, and plotted as ordinate. A smooth curve was then drawn between the points so plotted.

It will be observed that the microseisms become very marked in October and continue so with some variation till the end of March, corresponding to more or less boisterous weather on the North Atlantic. February shows the most sustained large amplitude of microseisms. July and August are almost quiescent, which, too, agrees with the long barometric gradients in the gulf of St. Lawrence and adjoining Atlantic.

The effective beating of the surf, due to steep gradients, is undoubtedly affected by the direction of the wind, *i. e.*, blowing on-shore or off-shore. This differentiation of direction has not yet been carried out in the analysis of microseisms.

Microseisms, especially if of much amplitude, are a very disturbing element in reading the first phase of an earthquake record, more particularly of a distant one, for which the horizontal component is always weak, and at best sometimes difficult to read.

For the identification of the various phases and as an aid for the reading of seismograms, the following table, being re-arranged from the one of Dr. V. Conrad*, of time intervals between phases, as indicated at the head of each column, is given.

PHASE TABLE.

Distance	$S–P$	$PR_1–P$	$PR_2–P$	$PR_3–P$	$SR_1–S$	$SR_2–S$	$SR_3–S$	$eL–P$
km.	s.	s.	s.	s.	s.	s.	s.	min.
1000	108	..	..	..	..	..	..	1·9
1100	118	..	..	..	..	..	..	2·1
1200	128	..	..	..	..	..	..	2·3
1300	137	..	..	..	..	..	..	2·5
1400	147	..	..	..	..	..	..	2·7
1500	157	..	..	..	..	..	..	2·9
1600	166	..	..	..	..	..	..	3·1
1700	175	..	..	..	..	..	..	3·4
1800	185	..	..	..	..	..	..	3·6
1900	194	..	..	..	..	..	..	3·8
2000	203	15	18	19	28	34	36	4·0
2100	211	17	21	22	32	39	42	4·3
2200	220	19	24	25	35	44	48	4·5
2300	228	21	27	28	39	48	54	4·8
2400	237	23	30	31	42	53	60	5·0
2500	245	25	33	34	46	58	66	5·3
2600	253	28	36	37	51	65	73	5·5
2700	260	31	40	41	56	71	81	5·8
2800	268	34	43	44	61	78	88	6·0
2900	275	37	47	48	66	84	96	6·3
3000	283	40	50	51	71	91	103	6·5
3100	290	43	55	56	77	99	111	6·8
3200	297	46	59	61	83	107	119	7·1
3300	303	49	64	66	89	114	128	7·3
3400	310	52	68	71	95	122	136	7·6
3500	317	55	73	76	101	130	144	7·9
3600	323	58	77	81	107	138	153	8·2
3700	329	62	82	86	113	146	161	8·4
3800	335	65	86	92	119	153	170	8·7
3900	341	69	91	97	125	161	178	9·0
4000	347	72	95	102	131	169	187	9·3
4100	353	76	100	107	137	178	197	9·6
4200	359	80	105	113	144	187	207	9·9
4300	364	84	109	118	150	196	216	10·2
4400	370	88	114	124	157	205	226	10·5
4500	376	92	119	129	163	214	236	10·8
4600	381	95	124	135	170	223	247	11·1
4700	386	98	129	141	177	233	258	11·4
4800	391	102	133	146	183	242	269	11·7
4900	396	105	138	152	190	252	280	12·0
5000	401	108	143	158	197	261	291	12·3

* "Seismische Registrierungen in Wien." K. Akad. d. Wissen. Neue Folge No. 39.

PHASE TABLE (*Continued*).

Distance	$S-P$	PR_1-P	PR_2-P	PR_3-P	SR_1-S	SR_2-S	SR_3-S	$eL-P$
km.	s.	s.	s.	s.	s.	s.	s.	min.
5100	407	112	149	164	203	270	302	12·6
5200	412	116	155	171	209	280	313	12·9
5300	418	119	160	177	214	289	324	13·3
5400	423	123	166	184	220	299	335	13·6
5500	429	127	172	190	226	308	346	13·9
5600	434	130	177	197	232	317	356	14·2
5700	440	134	183	204	237	326	366	14·5
5800	445	137	188	210	243	334	376	14·8
5900	451	141	194	217	248	343	386	15·1
6000	456	144	199	224	254	352	396	15·5
6100	461	147	204	230	259	360	407	15·8
6200	467	150	209	236	263	368	417	16·1
6300	472	153	215	242	268	377	428	16·5
6400	478	156	220	248	272	385	438	16·8
6500	483	159	225	254	277	393	449	17·1
6600	488	162	230	260	281	401	459	17·4
6700	493	165	235	266	285	408	468	17·7
6800	499	167	240	271	290	416	478	18·0
6900	504	170	245	277	294	423	487	18·3
7000	509	173	250	283	298	431	497	18·6
7100	514	175	254	289	301	439	507	18·9
7200	519	177	258	294	305	447	517	19·3
7300	524	179	262	300	308	455	527	19·6
7400	529	181	266	305	312	463	537	20·0
7500	534	183	270	311	315	471	547	20·3
7600	539	186	274	317	318	478	556	20·6
7700	545	188	279	323	321	484	565	20·9
7800	550	191	283	328	323	491	573	21·3
7900	556	193	288	334	326	497	582	21·6
8000	561	196	292	340	329	504	591	21·9
8100	566	198	296	346	332	511	600	22·2
8200	571	199	300	351	334	518	610	22·5
8300	575	201	303	357	337	525	619	22·9
8400	580	202	307	362	339	532	629	23·2
8500	585	204	311	368	342	539	638	23·5
8600	590	206	315	373	344	545	647	23·8
8700	595	208	319	379	347	551	656	24·1
8800	600	209	323	384	349	557	664	24·5
8900	606	211	327	390	352	563	673	24·8
9000	611	213	331	395	354	569	682	25·1
9100	616	215	335	400	356	575	691	25·4
9200	621	217	338	405	358	581	699	25·8
9300	625	220	342	411	361	587	708	26·1
9400	630	222	345	416	363	593	716	26·5
9500	635	224	349	421	365	599	725	26·8
9600	640	225	353	426	367	605	733	27·1
9700	644	226	357	431	368	611	742	27·4
9800	649	227	362	435	370	617	750	27·8
9900	653	228	366	440	371	623	759	28·1
10000	658	229	370	445	373	629	767	28·4
10100	662	230	373	451	376	635	776	28·7
10200	667	230	376	456	379	640	784	29·1
10300	671	231	380	462	381	646	793	29·4
10400	676	231	383	467	384	651	801	29·8
10500	680	232	386	473	387	657	810	30·1
10600	684	234	390	478	389	662	819	30·4
10700	688	235	394	483	391	668	827	30·8
10800	693	237	397	488	393	673	836	31·1

PHASE TABLE (*Concluded*).

Distance	$S-P$	PR_1-P	PR_2-P	PR_3-P	SR_1-S	SR_2-S	SR_3-S	$eL-P$
km.	s.	s.	s.	s.	s.	s.	s.	min.
10900	697	238	401	493	395	679	844	31·5
11000	701	240	405	498	397	684	853	31·8
11100	705	241	409	503	400	689	859	32·1
11200	709	242	412	507	403	695	865	32·5
11300	713	243	416	512	405	700	872	32·8
11400	717	244	419	516	408	706	878	33·2
11500	721	245	423	521	411	711	884	33·5
11600	725	247	426	526	414	716	894	33·8
11700	729	249	429	530	417	722	904	34·2
11800	733	252	432	535	421	727	915	34·5
11900	737	254	435	539	424	733	925	34·9
12000	741	256	438	544	427	738	935	35·2
12100	745	257	442	549	430	744	944	35·5
12200	748	259	445	555	434	750	952	35·9
12300	752	260	449	560	437	755	961	36·2
12400	755	262	452	566	441	761	969	36·6
12500	759	263	456	571	444	767	978	36·9
12600	762	265	459	576	448	773	986	37·3
12700	766	267	462	581	452	778	994	37·6
12800	769	269	466	585	455	784	1001	38·0
12900	773	271	469	590	459	789	1009	38·3
13000	776	273	472	595	463	795	1017	38·7

The following table gives the times of transmission along the respective paths of the longitudinal (P), and transverse (S) waves (first and second preliminary tremors) from the earthquake centre to points on the surface of the earth, distant the respective number of kilometres (every 100 km.), measured on the surface, from the epicentre. The original table or curve by Zöppritz gives the values for every 500 km. The intermediate values have been interpolated.

TRANSMISSION TIMES OF P AND S WAVES.

Distance	P	S	Distance.	P	S	Distance.	P	S
km.	s.	s.	km.	s.	s.	km.	s.	s.
100	14	25	1700	222	398	3300	384	688
200	28	50	1800	234	418	3400	393	703
300	41	74	1900	245	439	3500	402	719
400	55	99	2000	257	460	3600	410	733
500	69	124	2100	268	479	3700	418	747
600	82	148	2200	278	498	3800	426	761
700	96	172	2300	289	517	3900	434	775
800	109	196	2400	299	536	4000	442	789
900	123	220	2500	310	555	4100	449	802
1000	136	244	2600	320	572	4200	456	815
1100	149	266	2700	329	589	4300	464	828
1200	161	289	2800	339	607	4400	471	841
1300	174	311	2900	348	624	4500	478	854
1400	186	334	3000	358	641	4600	485	866
1500	199	356	3100	367	657	4700	492	878
1600	211	377	3200	376	672	4800	498	889

TRANSMISSION TIMES OF *P* AND *S* WAVES.—*Concluded.*

Distance.	*P*	*S*	Distance.	*P*	*S*	Distance.	*P*	*S*
km.	s.	s.	km.	s.	s.	km.	s.	s.
4900	505	901	7700	671	1216	10400	815	1491
5000	512	913	7800	677	1227	10500	820	1500
5100	518	925	7900	682	1238	10600	825	1509
5200	524	936	8000	688	1249	10700	830	1518
5300	530	948	8100	694	1259	10800	834	1527
5400	536	959	8200	699	1270	10900	839	1536
5500	542	971	8300	705	1280	11000	844	1545
5600	548	982	8400	710	1291	11100	849	1554
5700	554	994	8500	716	1301	11200	853	1562
5800	560	1005	8600	721	1312	11300	858	1571
5900	566	1017	8700	727	1322	11400	862	1579
6000	572	1028	8800	732	1333	11500	867	1588
6100	578	1039	8900	738	1343	11600	871	1596
6200	584	1050	9000	743	1354	11700	875	1604
6300	589	1062	9100	748	1364	11800	880	1613
6400	595	1073	9200	753	1374	11900	884	1621
6500	601	1084	9300	759	1384	12000	888	1629
6600	607	1095	9400	764	1394	12100	892	1637
6700	613	1106	9500	769	1404	12200	896	1645
6800	619	1118	9600	774	1414	12300	901	1652
6900	625	1129	9700	779	1424	12400	905	1660
7000	631	1140	9800	785	1433	12500	909	1668
7100	637	1151	9900	790	1443	12600	913	1675
7200	643	1162	10000	795	1453	12700	917	1683
7300	648	1172	10100	800	1462	12800	921	1690
7400	654	1183	10200	805	1472	12900	925	1698
7500	660	1194	10300	810	1481	13000	929	1705
7600	666	1205						

This table is useful for finding the time of occurrence of the quake at the epicentre, and thereby one is enabled to check the times of arrival of the *P* and *S* waves at different stations. When making comparisons of the different records for a given quake one is almost sure to find discordances in the times given for the phases, particularly for the first, or *P* phase.

It happens, not infrequently, that for a distant quake the *P* waves fail to record at all, the horizontal component of the impulse being so small, and that, instead, the *S* waves are read for *P* waves. In such a case the above table helps to show up such erroneous readings.

Frequently, in dealing with the determination of the epicentre of an earthquake, we have before us a collection of records far from harmonious; on the contrary, the records are conflicting, and, like a case before a judge, the evidence of each witness has to be carefully weighed, circumstantial evidence must be taken into account, so that the verdict may harmonize, as well as possible, with the nature of the evidence submitted.

A great drawback in the location of earthquakes in uninhabited parts, or in the ocean, is the very unsymmetrical distribution of earthquake stations, reliable ones, around the earth.

The determination of an epicentre is generally in the nature of a triangulation, graphically or mathematically, for which purpose it is obvious that our triangles should be 'well-conditioned' for reliable results.

When we are obliged to use the data of stations that are close together, we do not have the conditions necessary for getting satisfactory results. For such stations, an inaccuracy of some seconds in the reading of a seismogram, when combined with those of nearby stations, may give widely different geographical co-ordinates for the epicentre.

Although Japan has many earthquake stations for studying the seismic condition of the country, it is to be regretted that Japan does not publish weekly or monthly bulletins, as so many other stations do, of the earthquakes recorded elsewhere. It would be so helpful in their location.

The following table, computed for radius 6,367 km., gives the chord and middle ordinate for successive values of the arc from 1,000 to 20,000 km., or 9° to 180°.

Arc.		Chord.	Middle Ordinate.	Arc.		Chord.	Middle Ordinate
1000 km.	Angular.			1000 km.	Angular.		
		km.	km.			km.	km.
1	9° 00′	999	20	11	99° 00′	9683	2232
1·5	13° 30′	1497	44	11·5	103° 30′	10000	2425
2	18° 00′	1992	78	12	108° 00′	10302	2625
2·5	22° 30′	2484	122	12·5	112° 30′	10588	2830
3	27° 00′	2973	176	13	117° 00′	10858	3040
3·5	31° 30′	3456	239	13·5	121° 30′	11110	3256
4	36° 00′	3935	312	14	126° 00′	11346	3477
4·5	40° 30′	4407	394	14·5	130° 30′	11564	3702
5	45° 00′	4873	485	15	135° 00′	11765	3930
5·5	49° 30′	5331	585	15·5	139° 30′	11947	4163
6	54° 00′	5781	694	16	144° 00′	12111	4400
6·5	58° 30′	6222	812	16·5	148° 30′	12256	4639
7	63° 00′	6654	938	17	153° 00′	12382	4881
7·5	67° 30′	7074	1073	17·5	157° 30′	12489	5125
8	72° 00′	7485	1216	18	162° 00′	12577	5371
8·5	76° 30′	7884	1367	18·5	166° 30′	12646	5619
9	81° 00′	8270	1525	19	171° 00′	12695	5867
9·5	85° 30′	8644	1692	19·5	175° 30′	12724	6117
10	90° 00′	9004	1865	20	180° 00′	12734	6367
10·5	94° 30′	9351	2045	....	....	....	...

Record of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada. Latitude 45° 23′ 38″, Longitude 75° 42′ 57″ or 5h 02m 51s.8 W. Greenwich. Time: Mean Greenwich, midnight to midnight. Instruments: Two Bosch photographic horizontal pendulums. Nomenclature: Göttinger.

No.	Date	Char.	Phase	Time	Period	Amplitude A_E	Amplitude A_N	Remarks
	1910.			h. m. s.	s.	μ	μ	
1	Apl. 3	I	eL	19–35·5	14	......	......	
			F	19–57	......	......	......	
2	Apl. 11	I	eL	8–17	......	......	......	Earthquake reported from California.
3	Apl. 12	II_u	$eP?$	0–35–20	......	......	......	
			e	0–40–50	......	......	......	
			iPR_1	0–41–31	......	......	......	Epicentre 11,000 km.
			iS	0–46–44	4	......	......	
			M	0–46–50	......	12	18	
			PS_E	0–48–07	......	......	......	
			$eL?$	0–50–15	......	......	......	
			eL_N	1–03–36	14	......	......	
			eL_E	1–06–20	......	......	......	
			L_E	1–10	20	......	......	
			F	2–0	......	......	......	
4	Apl. 13	I	e	6–50–48	......	......	......	
			eL	7–02	14	......	......	
			F	7–38	......	......	......	
5	Apl. 27	I	$eS_E?$	1–38–49	......	2	......	N component very weak.
			eL	1–47	17	......	......	
			F	2–10	......	......	......	
6	May 1	I_u	e	19–01	......	......	......	
			eL_E	19–32 to 19–37	24	3	......	
			L_E	19–43 to 19–51	17	3	......	
			F	20–25	......	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude. A_E	Amplitude. A_N	REMARKS.
	1910.			h. m. s.	s.	μ	μ	
7	May 5	*I*	P_N?	0–34–50	3	......	......	Distance, 4000 km. Earthquake reported Cartago, Costa Rica.
			PR_1?	0·36–07	......	......	......	
			S_E	0–40–35	4	......	......	
			L_E	0–45·5	......	......	......	
			L	46 to 50	20	......	......	
			M_E	0–49	......	4	......	
			M_N	0–51	......	......	2	
			F	1–20	......	......	......	
8	May 11	*I*	P_N	7–31–39	2	......	......	
			PR_1	7–32–23	2·3	......	......	Distance, 3000 km. (San Domingo)?
			S_E	7–36·5	......	......	......	
			L_E	7–40	20	1	......	
			F	8–03	......	......	......	
9	May 12	*I*	P_N	9–11–03	2·5	......	......	Distance, 2500 km.
			S_E	9–15–06	......	......	......	No *L* recognizable.
			e_E	9–18–40	......	......	......	
			e_{EN}	9–20–06	......	......	......	
			e_{EN}	9–20–08	......	......	......	
			M_E	9–28	......	5	......	
			F	9–45	......	......	......	
10	May 13	*II*	P	8–07–20	......	......	......	
			S	8–14–36	......	......	......	Distance, 5600 km.
			L	8–21–16	8	......	......	
			L	8–25	14	......	......	
			M	8–32	......	12	7	
			L	8–43	12	......	......	
			L	8–53	11	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude. A_E	Amplitude. A_N	REMARKS.
	1910.			h. m. s.	s.	μ	μ	
	May 13	*II*	*F*	10–27	......	......	......	
11	May 15	*I*	P_N?	16–04–20	3	......	......	Sheet changed between 15–50 and 15–54
			eL_E?	16–07	8	......	......	
			F	16–20	......	......	......	
12	May 20	*I*	*P*	12–12–18	......	......	......	
			S	12–17–10	......	......	......	
			L	12–20–20	16	......	......	Distance, 3200 km.
			L	12–22	36	......	......	
			L	12–24	20	......	......	
			M	12–26·5	15	10	......	
			L	12–32	......	......	......	
			F	12–55	......	......	......	
13	May 22	I_u	*P*	6–36–28	......	......	......	Distance, 9600 km.
			PR_1	6–39–33	......	......	......	
			S	6–47–13	......	......	......	No distinct maximum.
			L	6–57	......	......	......	
			L_E	7–07	36	......	......	
			L_E	7–15	19	......	......	
			L_{NE}	7–22	16	......	......	
			F	8–00	......	......	......	
14	May 31	*II*	*P*	5–02–22	......	......	......	
			M	5–02–38	......	25	9	Distance, 4000 km.
			PR_1	5–03–51	......	......	......	
			S	5–08–00	......	......	......	
			SR_1	5–08–30	......	......	......	
			L	5–15–20	......	......	......	
			L	5–21	16	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude.		REMARKS.
						A_E	A_N	
	1910.			h. m. s.	s.	μ	μ	
	May 31	*II*	*F*	6–20	......	......	......	
15	June 1	I_u	*e?*	6–16–07	......	......	......	
			e?	6–21–37	......	......	......	
			eL	6–33·5	......	......	......	No record on N-S component.
			Nil	6–35 to 6–55	......	......	......	
			L	6–55·5	26	......	......	No maximum.
			L	6–59 to 7–05	20	......	......	
			L	7–08 to 7–16	16·5	......	......	
			L	7–52 to 7–55	20	......	......	
			F	8–15	......	......	......	
16	June 14	*I*	*P*	19–46–00	......	......	......	
			s	19–51–46	......	......	......	Distance, 4000 km.
			eL?	19–54	......	......	......	
			L	19–55–40	20	......	.....	
			F	20–26	......	......	......	
17	June 16	*II*	*eP(?)*	6–50–00	......	......	......	Strong microseisms prevail.
			i	6–51–00	5	8	......	
			s	7–00–50	......	......	......	
			L	7–07–40	20	......	......	Distance, 8600 km.
			M	7–08·5	20	17	......	
			L	7–28	42	......	......	
			L	7–34 to 7–37	20	15	......	
			L	7–48 to 7–52	16	......	......	
			L	8–42 to 8–44	20	......	......	
			L	8–51 to 8–53	16	......	......	
			F	9–25	......	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude. A_E	Amplitude. A_N	REMARKS.
	1910.			h. m. s.	s.	μ	μ	
18	June 25	*I*	*e*	19–42	7	......	......	Small microseisms obscure first preliminary tremors.
			L_N	19–57·0	23	......	......	
			F	20–55	......	......	......	
19	June 29	*I*	*eP?*	8–29–34	......	......	......	
			S?	8–36–52	......	......	......	Distance, 5800 km.
			L	8–47–13	20	......	......	
			M	8–53–40	......	......	6	The amplitudes by E-W component are about ⅔ of others.
			L	8–55	14·5	......	......	
			F	10–20	......	......	......	
			Lr	11–13	......	......	......	
			Mr	11–47	18	......	6	
			Lr	11–51	17	......	5	
			Lr	12–05	16	......	5	
			Lr	13–02	16	......	1	
			Fr	13–42	......	......	......	
20	July 2	*I*	*e*	17–25	......	......	......	
			L	17–29	9	......	......	
			M_N	17–30–10	7	4	3	
			F	17–50	......	......	......	
21	July 3	*I*	*e*	9–25–36	......	......	......	
			i	9–27–28	......	......	......	
			M_E	9–28–23	5	8	......	
			M_N	9–28–30	12	......	6·5	
			F	10–00	......	......	......	
22	July 4	*I*	*e*	4–51	......	......	......	
			i	5–08	......	......	......	
			L?	5–09	9	½	2	

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RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude. A_E	Amplitude. A_N	REMARKS.
	1910.			h. m. s.	s.	μ	μ	
	July 4	*I*	*F*	6–03	......	......	......	
23	July 7	*II*	*P*	4–51–30	......	......	......	
			S?	4–56–15	6	......	......	Distance, 3000 km.
			L	4–58–31	16	......	......	
			M	4–59–20	......	112	100	
			F	6–02	......	......	......	
24	July 7	*I*	*e*	8-35-16	6	......	......	No maximum
			i	8–39–22	6	......	......	
			eL	9–34	30	......	......	
			L	9–43	20	......	......	
			F	10–20	......	......	......	
25	July 17	*I*	*e*	8–14	......	......	......	
			F	8–22	......	......	......	
26	July 17	*I*	*P*	10–07–12	4	......	......	Distance, 4000 km.
			S	10–13–00	7	......	......	
			M	10–20–16	9	8	13	
			F	10–57	......	......	......	
27	July 20	*I*	*iP?*	3–47–19	......	......	......	
			i	3–56–08	7	3	5	
			i	3–56–52	6	6	......	
			L_N	4–01	20	......	......	
			F	4–25	......	......	......	
28	July 22	*I*	*L*	3–01	......	......	......	*L* very weak and not continuous.
			F	3–54	......	......	......	
29	July 29	*I*	*e*	10–48	......	......	......	Light of *N* component too weak for distinct record.
			L	10–59–14	19	......	......	
			L	11–33 to 11–41	22	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude. A_E	Amplitude. A_N	REMARKS.
	1810.			h. m. s.	s.	μ	μ	
	July 29	*I*	*F*	12–35	......	......	......	
30	Aug. 5	*II*	*iP*	1–38–30	......	......	......	
			iS	1–44–11	......	......	......	
			L_N	1–48	11	......	......	
			L_E	1–49·4	12	......	......	Distance, 3900 km.
			M_N	1–51·7	14	......	100	
			M_E	1–54	......	25	......	
			F	3–25	......	......	......	
			L_{EN}	4–08	22	......	......	
31	Aug. 11	*I*	*P(?)*	16–36–20	......	......	......	
			iS	16–41–31	......	......	......	Distance about 3400 km.
			L	16–42–10	12	......	......	
			M	16–47	12	12	10	
			F	17–48	......	......	......	
32	Aug. 21	*I*	P_N	5–56–22	......	......	......	*M* not well defined in *L*.
			P_E	5–56–36	......	......	......	Distance, 3600 km.
			iS_N	6–01–56	6	......	......	
			iS_E	6–01–51	6	......	......	
			SR_1	6–03–00	5	6	......	
			SR_2	6–03–53	5	4	......	
			L	6–05	12	......	......	
			F	7–18	......	......	......	
33	Sep. 1	*I*	*eL*	1–37	......	......	......	
			L	1–50	20	......	......	
			F	2–12	......	......	......	
34	Sep. 6	*I*	*iP*	20–14–37	......	......	......	
			iS	20–24–08	......	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude.		REMARKS.
						A_E	A_N	
	1910.			h. m. s.	s.	μ	μ	
	Sep. 6	*I*	*L*	20–41	12	......	......	Distance, 8250 km.
			M	20–46	20–23	2	4	
			L	20–46 to 50	20–23	......	......	
			F	21–35	......	......	......	
35	Sep. 7	*I*	*iP*	7–31–49	......	......	......	
			iS	7–38–44	5	......	......	
			PS	7–41–40	......	......	......	
			eL	7–45·5	......	......	......	
			L	8–14 to 32	20	......	......	Distance, 5300 km.
			M	8–20	20	4	6	
			F	9–32	......	......	......	
36	Sep. 7	*I*	*eL*	10–47	8	......	......	
			M	11–00	8	2	4	Possibly belongs to preceding quake.
			F	12–08	......	......	......	
37	Sep. 9	*II*	*iP*	1–23–42	5	......	......	
			iS	1–32–00	8	......	......	
			L	1–42	40	......	......	Distance, 6750 km.
			M	1–50	23	12	......	
			F	3–37	......	......	......	
38	Sep. 9	*I*	*e*	9–33	......	......	......	
			L_E	10–07	20	......	......	
			F	10–35	......	......	......	
39	Sep. 16	*I*	*e*	19–25–36	......	......	......	
			M	19–29	5–7	6	4	
			F	19–44	......	......	......	
40	Sep. 22	*I*	*P?*	12–50–51	4	......	......	
			S?	12–53–51	7	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude. A_E	Amplitude. A_N	REMARKS.
	1910			h. m. s.	s.	μ	μ	
	Sep. 22	I	eL_N	12–58	10	......	......	
			eL_E	13–02	10	......	......	
			F	13–27	....	......	......	
41	Sep. 24	II	iP	3–39–20	3	......	......	
			iS	3–44–52	5	......	......	
			L	3–50·5	32	......	......	Distance, 3750 km.
			M_N	3–58	24	......	13	
			F	5–05	....	......	......	
42	Sep. 24	I	iP	4–20–47	3–4	......	......	Shock during preceding disturbance.
			eE	4–23	10	......	......	
			M_N	4–23·7	6	......	12	
			M_E	4–24·7	5	25	......	
43	Sep. 24	I	eP?	18–47–17	5	......	......	
			S?	18–53–00	5	......	......	
			eL	19–02	16	......	......	
			M	19–02·5	16	2	2	
			F	19–46	....	......	......	
44	Oct. 4	I	iP_N	23–10–52	....	......	......	
			iS	23–19–34	5–6	15	15	Distance, 7200 km.
			eL	23–31·4	24	......	......	No distinct maximum.
			F	24–18	....	......	......	
45	Oct. 16	I	e	2–31	....	......	......	Microseisms obliterate phases.
			F	2–45	....	......	......	
46	Oct. 18	I	e	3–30	....	......	......	Microseisms obliterate phases.
			L	3–42	17	......	......	
			F	4–05	....	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude.		REMARKS.
						A_E	A_N	
	1910			h. m. s.	s.	μ	μ	
47	Nov. 6	II	P?	20–43–52	......	......	......	N-S component not working.
			L	20–50	......	......	......	
			M	20–50·7	......	50	......	
			F	22–00	......	......	......	
48	Nov. 9	II	P_E	6–28–22	......	......	......	No distinct maximum.
			S_E	6–34–00	......	......	......	
			L_N	6–36–20	10	......	......	Record conspicuous for the continuous and well-marked long waves.
			L	6–56	24	......	......	
			L	7–02 to 8–38	20–17	......	......	
			F	9–05	......	......	......	Distance, 3850 km.
49	Nov. 10	I	e	12–57	......	......	......	
			L_E	13–21	24	......	......	Strong microseisms.
			L_E	13–31	16	......	......	No phases recognizable.
			L_N	13–34	15	......	......	
			F	14–15	......	......	......	
50	Nov. 12	I	e	18–27	......	......	......	
			F	18–50	......	......	......	
51	Nov. 14	I	e	8–27	......	......	......	
			L_E	8–33	22	......	......	
			L_N	8–35	24	......	......	
			L_E	8–41	15	......	......	
			M_N	8–47	14	......	6	
			F	9–21	......	......	......	
52	Nov. 15	I	e_N	0–30·3	......	......	......	
			F	0–51	......	......	......	
53	Nov. 15	I	e_N	14–32	......	......	......	
			L_N	14–41	13	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude. A_E	Amplitude. A_N	REMARKS.
	1910			h. m. s.	s.	μ	μ	
	Nov. 15	*I*	M_N	14–50	......	......	6	
			L_N	15–20	20	......	......	
			F	15–47	......	......	......	
54	Nov. 26	*II*	*P?*	5–07–16	......	......	......	Microseisms mask *P* and *S*.
			S?	5–11–20	......	......	......	
			eL	5–18	20	......	......	
			L	5–26	20	......	......	
			M_N	5–42·5	20	......	8	Period of *L* decreases.
			M_E	5–48	20	8	......	
			L	5–42 to 6–18	24–16	......	......	
			F	7–55	......	......	......	
55	Nov. 29	*I*	eL_N	3–18	20	......	......	*E* component very feeble.
			L_N	3–29 to 3–43	20–16	......	......	
			F	3–56	......	......	......	
56	Dec. 4	*I*	e_N?	11–43·5	......	......	......	
			e	11–51	......	......	......	
			e	12–12	......	......	......	
			L	12–16 to 12–30	20–16	......	......	*L* decrease in period
			F	13–07	......	......	......	
57	Dec. 10	*I*	*e*	9+	......	......	......	Unfortunately a poor photographic sheet makes the diagram only readable in patches.
			L_{NE}	10–35 to 10–44	16·5	......	......	
			F	13	......	......	......	
58	Dec. 13	*II*	P_E	11–56–10	......	......	......	
			S_E	12–05–46	......	......	......	Distance, 8300 km.
			L_N	12–21·5	28	......	......	Strong microseisms prevailed.
			L_N	12–29	24	......	......	
			L_E	12–31 to 12–33	20	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude.		REMARKS.
						A_E	A_N	
	1910.			h. m. s.	s.	μ	μ	
	Dec. 13	II	M_N	12–31·5	20	......	21	
			M	12–39	18–16	15	17	
			L_N	12–40 to 12–45	16	......	......	
			F	14–48	......	......	......	
59	Dec. 14	I	P_E	21–04–18	3	......	......	Microseisms prevailed.
			i_E	21–09–32	......	......	......	Phases difficult to read.
			S_E?	21–10–35	5	......	4	Long waves almost wholly wanting.
			i_N	21–11–20	......	4	......	No maximum.
			i_E	21–11–25	......	......	......	
			L_E	21–17·3	......	......	......	
			i_N	21–19–19	......	......	......	
			i_N	21–23–23	......	......	......	
			L_N	21–25	12	......	......	
			F	22–00	......	......	......	
60	Dec. 16	I	P	15–05–20	......	......	......	No record 15–21 to 15–38. Changing sheet, etc.
			M?	16–00	24	......	12	
			L	16–09 to 16–13	18	5	10	
			L	16–26 to 16–28	16	......	......	
			F	18–00	......	......	......	
61	Dec. 21	I	P_N	10–31–00	......	......	......	
			PR_1	10–32–24	......	......	......	Distance, 4300 km. Microseisms prevailed.
			S_N	10–37–00	......	......	......	
			L_N	10–46·9	20	......	......	
			L	10–48 to 10–53	15–11	......	......	
			F	11–25	......	......	......	
62	Dec. 23	I	P?	0–50–32	......	......	......	Microseisms prevailed.

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude. A_E	Amplitude. A_N	REMARKS.
	1910.			h. m. s.	s.	μ	μ	
	Dec. 23	*I*	*P?*	0-58-38	......	......	......	*P* difficult to read. *S* not recognized.
			L	1-05	25	......	......	
			L	1-11 to 1-14	16-15	......	......	
			M_N	1-11·5	15	......	6	
			M_E	1-12·2	16	6	......	
			F	2-20	......	......	......	
63	Dec. 28	*I*	*P?*	17-46-14	2	......	......	
			S?	17-49-06	......	......	......	
			F?	18-30	......	......	......	
64	Dec. 29	*I*	eL_N	14-18·3	16	......	......	
			L_N	14-23	20	......	......	
			F	14-55	......	......	......	
65	Dec. 30	*I*	*P?*	1-07-49	......	......	......	*E-W* Component weaker.
			S?	1-15-34	......	......	......	
			eL?	1-18·2	......	......	......	
			L	1-26	10	......	......	
			F	2-00	......	......	......	
66	Dec. 30	*I*	*P*	3-26-42	2	......	......	
			S	3-31-28	......	......	......	*E-W* Component weaker.
			L	3-43	18	......	......	
			F	4-13	......	......	......	
67	1911 Jan. 1	*I*	e_N	10-41-36	......	......	......	
			L_N	11-09·7	20	......	......	Preceded by extremely strong microseisms.
			L_N	11-25	13	......	......	
			F	11-55	......	......	......	
68	Jan. 2	I^-	e_E	11-07	......	......	......	
			e_N	11-09·7	......	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude.		REMARKS.
						A_E	A_N	
	1911			h. m. s.	s.	μ	μ	
	Jan. 2	*I*	L_N	11-36 to 11-39	29	......	......	
			L	11-41	20	......	......	
			F	12-00	......	......	......	
69	Jan. 2	*I*	e	23-19	......	......	......	
			L	23-48 to 23-53	20	......	......	
			L	23-55	18	......	......	
			L	24-00	16	......	......	
			F	24-55	......	......	......	
70	Jan. 3	*I*	e_N	8-12·5	......	......	......	
			L_N	8-18·5	20	......	......	*E* comp. shows only traces.
			F	8-43	......	......	......	
71	Jan. 3-4	*II*	P_N	23-38-36	3	......	......	
			P_E	23-38-43	3	......	......	
			PR_1	23-42-20	......	......	......	
			S_N	23-49-16	8	......	......	Distance, 9800 km.
			S_E	23-49-40	8	......	......	
			L_N	23-55-40	......	......	......	Turkestan quake.
			L_E	23-56	......	......	......	
			L	23-57	36-40	50	135	
			M	0-16	20	170	......	
			M	0-18	20	......	335	
			L	0-36 to 1-06	15	......	......	
			F	2-50	......	......	......	
72	Jan. 7	*I*	e	2-33-12	......	......	......	
			$S?$	2-44-18	......	......	......	Partly masked by wind effect.
			L	3-03	16	......	......	
			L	3-20	20	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude. A_E	Amplitude. A_N	REMARKS.
	1911			h. m. s.	s.	μ	μ	
	Jan. 7	*I*	*L*	3-28	19	......	......	
			F	4-10	......	......	......	
73	Jan. 9	*I*	*e*	4-46	......	......	......	Waves appear to continue for some hours, but difficult to differentiate from wind effect as shown by anemogram.
74	Jan. 10	*I*	*e*	11-00-32	......	......	......	
			F	11-10	......	......	......	
75	Jan. 10	*I*	*e*	12-31	......	......	......	
			F	12-57	......	......	......	
76	Feb. 5	*II*	*P*	4-30-42	4	......	......	
			PR_1	4-32-40	......	......	......	
			S	4-36-02	6	......	......	Distance, 3560 km.
			L	4-38-34	19	......	......	
			M	4-40-20	19	67	60	
			L_N	4-44	20	......	......	
			F	6-07	......	......	......	
77	Feb. 7	*I*	*P*	2-27-18	......	......	......	
			S	2-32-36	......	......	......	
			L	2-35-08	8-12	......	......	
			M_N	2-36·9	12	......	6	
			M_E	2-38·7	6	8	......	
78	Feb. 16	*I*	*e*	20-24-57	......	......	......	
			F	20-31	......	......	......	
79	Feb. 17	*I*	*e*	2-50-50	......	......	......	
			M	2-51-20	5·5	8	4	
			F	3-06	......	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Continued.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude. A_E	Amplitude. A_N	REMARKS.
	1911			h. m s.	s.	μ	μ	
80	Feb. 17	*I*	*e*	14–40–25	......	......	......	
			M	14–40–46	5·5	8	4	
			F	15–07	......	......	......	
81	Feb. 18	*I*	*e*	2–05	......	......	......	
			i	2–12	......	......	......	
			L	2–13	10	......	......	
			F	2–57	......	......	......	
82	Feb. 18	*II*	e_N	19–04–30	......	......	......	
			e_E	19–04–34	......	......	......	
			iP_N	19–04–45	......	......	......	No distinct *S*.
			iP_E	19–04–43	......	......	......	
			L_E	19–23	16	......	......	Press report quake in Monastir.
			L_N	19–24·5	20	......	......	
			M_N	19–35	20	......	60	Distant 7350 km.
			M_E	19–36	14	30	......	
			L_E	19–41 to 19–43	14	......	......	
			L_N	19–45 to 19–50	14	......	......	
			F	20–54	......	......	......	
83	Feb. 19	*I*	*e*	2–31·6	20	......	......	
			F	2–42	......	......	......	
84	Feb. 26	*I*	*e*	13–00–20	10	......	......	
			L	13–07·5	30	......	......	
			F	13–25	......	......	......	
85	Mar. 11	*I*	*eL*	4–14	......	......	......	*N-S* component has now magnetic damping.
			L	4–17	20	......	......	*E-W* component retains air damping.
			L	4–22	19	......	......	

RECORD of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada, etc.—*Concluded.*

No.	Date.	Char.	Phase.	Time.	Period	Amplitude.		Remarks.
						A_E	A_N	
	1911			h. m. s.	s.	μ	μ	
	Mar. 11	*I*	*L*	4-34	16	......	......	*E-W* considerably masked by microseisms.
			F	5-00	......	......	......	
86	Mar. 13	*I*	*P*	7-40-31	......	......	......	
			eL	7-41-16	10	......	......	
			F	7-56	......	......	......	
87	Mar. 15	*I*	*e*	2-26·4	......	......	......	
			F	2-44	......	......	......	
88	Mar. 19	*I*	*P*	4-31-07	......	......	......	Epicentre 4040 km., magnetic damping shows no microseisms, being very small. Air damping shows them and thereby almost masks quake.
			S	4-36-56	......	......	......	
			L	4-44-00	20	......	......	
			L	4-47	14	......	......	
			F	5-01	......	......	......	
89	Mar. 21	*I*	*eL*	3-20	14	......	......	

TERRESTRIAL MAGNETISM.

The magnetic survey of Canada has been continued during the past year. Two observers were in the field. Mr. C. A. French occupied 48 stations along the line of the Canadian Pacific railway between Chapleau and Moosejaw, a distance of 1,200 miles, giving an average distance between the stations of about 25 miles.

Mr. J. W. Menzies occupied 44 stations distributed over western Ontario between Napanee and Windsor, with intervals approximately of 25 miles also.

At all the stations observations were taken for declination, dip and intensity, besides the necessary ones for azimuth and latitude. Mr. French used the magnetic outfit of preceding years, and described in previous reports, being a Tesdorpf magnetometer, Kew dip circle, and Watt transit. Mr. Menzies had a Cooke magnetometer, Kew dip circle, and Watt transit. As usual, both observers made comparison observations at the Agincourt Magnetic Observatory, before and after the season's work, to standardize the field instruments.

At all the stations along the Canadian Pacific railway the eastern and western magnetic elongations were observed, and the mean taken for the magnetic meridian or declination. Observations were taken at other times, also, for the purpose of eventually preparing a diurnal variation table for those northern parts or regions.

The observations in Ontario for declination did not include those of elongation, but invariably were duplicated; the general order of observations being: Azimuth, declination, dip, oscillations, deflections, deflections, oscillations, dip and declination. To the declination observations was then applied the correction or diurnal variation obtained from data tabulated from the continuous records of the Agincourt Magnetic Observatory.

A number of the stations occupied during the past season had been occupied by the Carnegie Institution in 1906, so that by the comparison of the observations in 1906 and 1910 we obtain a value for the secular variation for the interval, and also the value for the average annual change in declination. The true nature of the secular variation is still unknown, as well as of the law of its slow change. We can interpolate with a fair degree of accuracy, but extrapolation is very uncertain, especially if the time is anything but a very few years in advance. For example, the Toronto Magnetic Observatory (now at Agincourt, some 13 miles away, to avoid influence of trolly lines) has the longest reliable magnetic record in America, so that the empirical formula deduced from the long period would be expected to give a pretty accurate value for extrapolation. The formula for Toronto, given in Appendix No. 9, Report for 1879 of the United States Coast and Geodetic Survey, deduced from 40 years' observations (1840 – 1880), is:

$D = +3°.60 + 2°.82 \sin (1.4m - 44°.7) + 0°.09 \sin (9.3m + 136°) + 0°.08 \sin (19m + 247°)$, where $m = t - 1850$, t being the year for which the declination is sought.

Taking $t = 1910$, hence $m = 60$, we obtain

$D = 5° 17'$, whereas the actually observed declination was $6° 02'$ (January, 1910). Although the stations are not quite identical, yet the difference of three-quarters of a degree shows the unreliability of extrapolating for years in advance.

We may cite an interesting case of secular variation in connection with Haussmann's magnetic survey of Württemberg, in 1900. Kornthal, near Stuttgart, was his base station, and comparison observations were made with the magnetic observatory at Potsdam. From the subsequent observations in 1902, the annual change for Kornthal was found to be 4′.5. Based on this, values for declination—or direction of the compass needle—were published some years in advance. In 1905, Bavaria undertook a magnetic survey of its state, and amongst the stations was Ulm, a border city between the above two states. The declination observed here was found to show a greater annual change than had been found only a few years before. The continuous records of Potsdam confirmed this. Thus Potsdam showed an annual decrease in declination, up to 1903, of from 4′.2 to 4′.0, and from 1904 to 1910 it increased to 7′.4, which, for Kornthal, would be 7′.5, *i.e.*, 3′.0 more than was determined in 1900-1902, and which was supposed to hold for some years, but which was subsequently found to be materially unreliable to be thus applied.

Although the same annual change holds for a fairly large area, say a hundred miles square, yet individual places in such an area show deviations from the normal.

As in the past few years, a magnetic map accompanies this report, showing the direction of the magnetic meridian at the stations occupied during the year. It is found that these magnetic maps find favour with the public, more so than do those showing irregular curved lines of equal declination, *i.e.*, isogonic lines. Although these lines are based on magnetic observations at particular places, yet the continuous line is more or less hypothetical, and its meaning is not so readily understood by the public as a definite direction at a station of the magnetic meridian, together with its declination or variation of the compass as it is called by the ordinary man.

Mr. C. A. French reports on his work during the season as follows:—

The instruments used on the Magnetic Survey during the season of 1910 included a Tesdorpf fibre declinometer and magnetometer, No. 1977, for measuring declination and horizontal intensity; Dover dip circle, No. 145, for inclination; Troughton and Simms 6-inch theodolite for time, latitude and azimuth, and a half-seconds mean-time chronometer, Bond 511, for determining the time of oscillations.

With few exceptions, latitude was obtained from meridian altitudes of the sun, circle right and left. The azimuth of the reference point, and time were obtained from the altitude of the sun, and, whenever possible, two observations were taken, one about 9 a.m., and one about 3 p.m., at each station. In every case, the magnetic declination was obtained by taking the mean of the eastern elongation, which usually occurs between 7 and 8 a.m., and the western elongation between 1 and 2 p.m.

It frequently happened that the number of days of morning elongations differed from the number of days of afternoon elongations, in which case the mean of the mornings was taken as one observation and the mean of the afternoons as one. In addition to the elongations, there were taken a number of observations for declination which were not used to obtain a mean value, owing to the fact that no corrections for diurnal variation were available for this region. It is hoped, however, that from these results, combined with those of the preceding and next year, a table of diurnal variations will be compiled, which will be of service in reducing observations in succeeding years. A summary of the corrections obtained from observations during the season are given below. In table A are given the actual observations for declination, and the time of each; the mean declination obtained from the mean of the elongations; and the difference between the mean declination and the individual observations. These differences reduced to the even hour and half-hour, are given in table B.

TABLE A.

Station.	Date.	L. M. Time.	Observed Declination.	Mean of E & W Elongations.	Correction for Diurnal Variation
	1910	h. m.	° ′	° ′	′
Chapleau......	May 7...	7–14	4–07·7*W*	4–16·4*W*	− 8·7
		8–55	13·1		− 3·3
		10–05	17·5		+ 1·1
		10–40	20·3		+ 3·9
		11–37	23·0		+ 6·6
		1–11	24·0		+ 7·6
		3–04	22·2		+ 5·8
		3–51	20·9		+ 4·5
		5–01	18·9		+ 2·5
	May 9...	7–34	10·2		− 6·2
		8–55	10·3		− 6·1
		9–34	12·1		− 4·3
		9–51	13·9		− 2·5
		10–24	14·6		− 1·8
		10–58	17·7		+ 1·3
		11–46	21·0		+ 4·6
		1–06	21·5		+ 5·1
		2–36	23·7		+ 7·3

TABLE A—*Continued.*

Station.	Date.	L. M. Time.	Observed Declination.	Mean of E & W Elongations.	Correction for Diurnal Variation
	1910	h. m.	° ′	° ′	′
Wayland......	May 10..	10–07	5–09·0*W*	5–08·8*W*	+ 0·2
		12–55	14·8		+ 6·0
		3–27	13·6		+ 4·8
		5–05	10·6		+ 1·8
	May 11..	8–07	2·7		− 6·1
		9–34	4·3		− 4·5
		10–26	8·6		− 0·2
		12–50	15·0		+ 6·2
Missinaibi.....	May 14..	12–52	5–58·8*W*	5–48·8*W*	+10·0
		4–17	51·5		+ 2·7
		6–19	48·6		− 0·2
	May 16..	7–29	42·0		− 6·8
		8–49	48·0		− 0·8
		10–03	54·7		+ 5·9
		10–28	54·7		+ 5·9
		11–25	53·7		+ 4·9
		12–49	52·5		+ 3·7
		2–08	53·0		+ 4·2
		3–42	53·0		+ 4·2
Grasett.......	May 19..	7–22	3–39·8*W*	3–46·1*W*	− 6·3
		9–05	42·8		− 3·3
		12–52	53·6		+ 7·5
		4–20	47·0		+ 0·9
		5–43	42·2		− 3·9
	May 20..	7–27	39·8		− 6·3
		9–02	39·2		− 6·9
		9–56	44·3		− 1·8
		10–28	48·4		+ 2·3
		1–02	51·0		+ 4·9
		2–51	54·1		+ 8·0
		3–36	50·5		+ 4·4
		5–27	46·0		− 0·1
White River...	May 23..	7–34	3–05·2*W*	3–11·9*W*	− 6·7
		8–40	9·2		− 2·7
		9–40	14·3		+ 2·4
		10–29	16·6		+ 4·7
		11–28	18·8		+ 6·9
		1–09	21·5		+ 9·6
		3–26	17·6		+ 5·7
	May 25..	7–54	3·0		− 8·9
		9–46	9·3		− 2·6
		10–26	13·4		+ 1·5
		12–45	17·6		+ 5·7
Montizambert.	May 27..	7–35	2–15·7*W*	2–22·3*W*	− 6·6
		9–08	19·1		− 3·2
		10–30	24·4		+ 2·1
		1–02	28·6		+ 6·3
		3–27	28·6		+ 6·3
		4–11	23·6		+ 1·3
	May 28..	7–42	16·4		− 5·9
Heron Bay....	May 30..	7–34	2–25·4*W*	2–33·4*W*	− 8·0
		9–05	28·5		− 4·9
		10–04	28·1		− 5·3
		11–30	37·2		+ 3·8
		1–00	40·2		+ 6·8
		3–34	36·5		+ 3·1

TABLE A—*Continued.*

Station.	Date.	L. M. Time.	Observed Declination.	Mean of E & W Elongations.	Correction for Diurnal Variation
	1910	h. m.	° ′	° ′	′
Heron Bay....	May 31.	7−37	2−27·8	2−33.4*W*	− 5·6
		8−45	24·6		− 8·8
		9−44	31·6		− 1·8
		10−24	30·1		− 3·3
		1−07	40·2		+ 6·8
Middleton.....	June 4...	7−20	17−58·7*E*	17−48·9*E*	− 9·8
		9−18	51·4		− 2·5
		10−28	47·0		+ 1·9
		12−59	39·1		+ 9·8
		3−00	41·4		+ 7·5
		5−55	47·7		+ 1·2
Schreiber.....	June 7...	7−21	0−25·2*W*	0−31·7*W*	− 6·5
		9−09	24·1		− 7·6
		10−02	28·1		− 3·6
		10−32	31·6		− 0·1
		11−19	35·6		+ 3·9
		1−29	37·7		+ 6·0
		3−18	38·1		+ 6·4
		4−48	35·1		+ 3·4
Gravel........	June 10..	7−47	0−30·8*E*	0−25·1*E*	− 5·7
		9−15	30·3		− 5·2
		10−21	26·2		− 1·1
		1−37	19·3		+ 5·8
		3−31	20·5		+ 4·6
Nipigon.......	June 11..	8−02	1−14·6*E*	1−07·0*E*	− 7·6
		1−12	00·9		+ 6·1
	June 13..	7−32	13·6		− 6·6
		9−28	8·3		− 1·3
		10−18	4·1		+ 2·9
		1−09	0−58·8		+ 8·2
		11−20	1−00·3		+ 6·7
		3−03	1·8		+ 5·2
Dorion........	June 14..	7−24	1−44·9*E*	1−39·5*E*	− 5·4
		9−20	41·0		− 1·5
		10−31	37·8		+ 1·7
		1−14	33·6		+ 5·9
		4−01	34·1		+ 5·4
Mackenzie....	June 15..	7−40	2−54·9*E*	2−49·3*E*	− 5·6
		9−02	54·9		− 5·6
		10−34	49·5		− 0·2
		1−40	43·6		+ 5·7
		4−09	47·4		+ 1·9
Fort William..	June 17.	7−48	3−21·3*E*	3−16·5*E*	− 4·8
		10−33	12·3		+ 4·2
		1−15	11·5		+ 5·0
		3−53	15·1		+ 1·4
	June 18..	8−08	24·0		− 7·5
		1−08	9·4		+ 7·1
Kaministikwia	June 22..	8−04	0−33·2*E*	0−25·3*E*	− 7·9
		10−32	26·6		− 1·3
		1−42	17·4		+ 7·9
		4−01	25·3		0·0
Savanne.......	June 27..	7−41	4−35·7*E*	4−28·1*E*	− 7·6
		9−26	33·2		− 5·1
		10−32	29·0		− 0·9
		1−34	21·6		+ 6·5

TABLE A—*Continued.*

Station.	Date.	L. M. Time.	Observed Declination.	Mean of E & W Elongations.	Correction for Diurnal Variation
	1910	h. m.	° ′	° ′	′
Savanne......		4—04	4—23·5	4—28.1*E*	+ 4·6
		4—43	24·1		+ 4·0
	June 28..	7—48	35·7		− 7·6
		10—31	28·5		− 0·4
		11—40	23·3		+ 4·8
		1—11	19·3		+ 8·8
Niblock.......	June 30..	7—43	4—62·0*E*	4—54·5*E*	− 7·5
		9—33	59·6		− 5·1
		10—34	55·9		− 1·4
		1—36	47·2		+ 7·3
		4—33	51·9		+ 2·6
	July 1....	7—23	62·0		− 7·5
		10—34	53·0		+ 1·5
		12—58	46·8		+ 7·7
Martin.........	July 2....	7—33	5—05·3*E*	4—58·1*E*	− 7·2
		9—33	2·8		− 4·7
		10—32	4—57·9		+ 0·2
		11—46	55·1		+ 3·0
		1—36	53·1		+ 5·0
		4—34	54·9		+ 3·2
	July 4 ..	7—52	5—05·1		− 7·0
		9—26	2·2		− 4·1
		9—56	0·6		− 2·5
		10—36	4—58·9		− 0·8
		10—56	55·1		+ 3·0
		1—21	49·4		+ 8·7
Ignace........	July 6....	7—29	6—15·2*E*	6—10·5*E*	− 4·7
		9—25	9·2		+ 1·3
		10—24	5·9		+ 4·6
		1—19	1·0		+ 9·5
		3—49	5·6		+ 4·9
		4—49	8·8		+ 1·7
	July 7...	7—34	19·5		− 9·0
		10—32	8·2		+ 2·3
		1—22	4·2		+ 6·3
	July 8....	7—17	19·2		− 8·7
		9—29	13·1		− 2·6
		10—30	11·0		− 0·5
		1—24	4·0		+ 6·5
		3—34	6·7		+ 3·8
Taché.........	July 11...	7—41	6—63·7*E*	6—57·4*E*	− 6·3
		9—38	65·6		− 8·2
		10—37	57·5		− 0·1
		1—41	50·7		+ 6·7
		4—38	54·2		+ 3·2
	July 12...	7—31	65·0		− 7·6
		7—51	64·4		− 7·0
		8—01	63·8		− 6·4
		8—21	64·2		− 6·8
		9—36	62·4		− 5·0
		10—34	58·8		− 1·4
		1—51	49·9		+ 7·5
Wabigoon.....	July 13..	1—50	7—33·2*E*	7—39·0*E*	+ 5·8
		4—46	37·2		+ 1·8
	July 14...	8—00	46·7		− 7·7
		10—00	43·6		− 4·6

TABLE A—*Continued.*

Station.	Date.	L. M. Time.	Observed Declination.	Mean of E & W Elongations.	Correction for Diurnal Variation
	1910	h. m.	° ′	° ′	′
Wabigoon		10−35	7−41·0	7−39.0*E*	− 2·0
		1−30	29·2		+ 9·8
Dryden.......	July 16...	8−09	8−24·8*E*	8−14·1*E*	−10·7
		10−32	14·7		− 0·6
		1−41	2·9		+11·2
		4−42	9·6		+ 4·5
	July 17...	7−24	23·9		− 9·8
		1−24	4·8		+ 9·3
Eagle.........	July 18...	2−27	6−27·7*E*	6−34·7*E*	+ 7·0
		4−29	31·4		+ 3·3
	July 19...	7−18	42·2		− 7·5
		9−31	38·3		− 3·6
		10−34	34·0		+ 0·7
		11−52	27·5		+ 7·2
		2−00	28·0		+ 6·7
		7−38	44·4		− 9·7
	July 20...	4−59	30·4		+ 4·3
Vermilion.....	July 21...	7−37	7−51·3*E*	7−42·8*E*	− 8·5
		9−00	49·3		− 6·5
		9−39	46·0		− 3·2
		10−33	42·2		+ 0·6
		1−47	34·2		+ 8·6
		4−55	39·3		+ 3·5
Hawk Lake...	July 23...	7−42	7−38·8*E*	7−28·4*E*	−10·4
		10−31	30·2		− 1·8
		2−04	19·3		+ 9·1
		4−56	23·5		+ 4·9
	July 24...	7−42	35·7		− 7·3
		10−26	30·8		− 2·4
		12−05	25·8		+ 2·6
		1−54	19·7		+ 8·7
Kenora........	July 26...	10−37	9−60·2*E*	10−00·4*E*	+ 0·2
		1−49	51·8		+ 8·6
		4−48	54·3		+ 6·1
	July 27...	7−39	67·8		− 7·4
		10−31	62·5		− 2·1
		1−57	54·2		+ 6·2
Kalmar.......	July 28...	10−35	9−31·4*E*	9−31·7*E*	+ 0·3
		2−05	25·4		+ 6·3
		4−41	25·8		+ 5·9
		6−27	26·8		+ 4·9
	July 29...	7−02	37·9		− 6·2
Rennie........	July 29...	2−03	10−13·4*E*	10−19·7*E*	+ 6·3
		4−38	16·2		+ 3·5
	July 30...	7−53	26·1		− 6·4
		10−26	20·5		− 0·8
		1−46	13·5		+ 6·2
		4−28	16·3		+ 3·4
	July 31...	7−56	25·9		− 6·2
Whitemouth...	Aug. 1...	1−39	10−49·4*E*	10−57·0*E*	+ 7·6
		4−58	54·6		+ 2·4
	Aug. 2...	7−42	66·1		− 9·1
		10−04	54·7		+ 2·3
		10−53	52·5		+ 4·5
		1−45	46·3		+10·7
		4−18	51·2		+ 5·8

TABLE A—*Continued.*

Station.	Date.	L. M. Time.	Observed Declination.	Mean of E & W Elongations.	Correction for Diurnal Variation
	1910	h. m.	° ′	° ′	′
Whitemouth..		7−40	10−59·9(omit)	10−57.0*E*	
Norquay......	Aug. 4...	1−49	11−13·0*E*	11−23·0*E*	+10·0
		4−33	19·6		+ 3·4
	Aug. 5...	7−54	32·1		− 9·1
		10−40	23·6		− 0·6
		1−56	14·8		+ 8·2
		4−29	20·6		+ 2·4
Winnipeg......	Aug. 8...	10−33	13−58·1*E*	13−56·7*E*	− 1·4
		1−42	47·9		+ 8·8
	Aug. 9...	7−34	63·6		− 6·9
		10−32	59·9		− 3·2
		1−34	51·7		+ 5·0
Marquette....	Aug. 11..	1−30	13−09·6*E*	13−17·7*E*	+ 8·1
		4−40	12·4		+ 5·3
	Aug. 12..	7−22	25·3		− 7·6
		10−36	18·5		− 0·8
		1−33	10·6		+ 7·1
Portage-la-Prairie......	Aug. 15..	10−42	9—24·4*E*	9—26·9*E*	+ 2·5
		1−32	20·9		+ 6·0
	Aug. 16..	7−50	34·8		− 7·9
		10−32	25·2		+ 1·7
		1−37	16·9		+10·0
McGregor.....	Aug. 17..	10−35	13—08·7*E*	13—09·8*E*	+ 1·1
		1−55	1·1		+ 8·7
		4−37	4·0		+ 5·8
	Aug. 18..	7−50	18·5		− 8·7
Carberry......	Aug. 19..	7−43	15−51·6*E*	15−44·0*E*	− 7·6
		1−38	36·3		+ 7·7
		4−28	40·0		+ 4·0
	Aug. 20..	8−06	52·1		− 8·1
		10−33	40·8		+ 3·2
		1−35	36·1		+ 7·9
Brandon......	Aug. 23..	7−36	15−12·0*E*	15−03·9*E*	− 8·1
		10−33	15−03·9		0·0
		1−34	14−53·5		+10·4
		4−49	14−58·0		+ 5·9
	Aug. 24..	7−59	15−13·9		−10·0
		10−33	15−02·9		+ 1·0
		1−39	14−56·4		+ 7·5
	Aug. 25..	7−34	15−10·9		− 7·0
		1−31	14−56·5		+ 7·4
Griswold......	Aug. 26..	7−41	16−11·3*E*	16−04·6*E*	− 6·7
		10−33	4·7		− 0·1
		1−44	15−57·8		+ 6·8
		4−24	61·4		+ 3·2
Virden........	Aug. 27..	7−57	16−49·9*E*	16−43·1*E*	− 6·8
		10−32	45·0		− 1·9
		1−37	36·6		+ 6·5
	Aug. 28..	7−37	49·4		− 6·3
Kirkella.......	Aug. 30..	1−25	16−08·0*E*	16−13·9*E*	+ 5·9
		4−35	15·4		− 1·5
	Aug. 31..	8−00	19·5		− 5·6
		10−30	9·1		+ 4·8
		1−23	8·6		+ 5·3

TABLE A—*Concluded.*

Station.	Date.	L. M. Time.	Observed Declination.	Mean of E & W Elongations.	Correction for Diurnal Variation
	1910	h. m.	° ′	° ′	′
Wapella.......	Sep. 1...	7−38	17−58·7*E*	17−50·6*E*	− 8·1
		10−28	47·7		+ 2·9
		1−48	44·2		+ 6·4
		7−36	57·7		− 7·1
		10−28	48·6		+ 2·0
		1−21	42·0		+ 8·6
Broadview....	Sep. 3....	7−33	17−20·9*E*	17−13·3*E*	− 7·6
		10−29	11·9		+ 1·4
		1−25	6·4		+ 6·9
		4−20	12·8		+ 0·5
	Sep. 5....	7−45	19·5		− 6·2
		10−30	13·2		+ 0·1
		1−35	6·5		+ 6·8
		3−40	11·5		+ 1·8
Wolseley......	Sep. 9....	1−35	18−10·2*E*	18−18·1*E*	+ 7·9
		4−22	14·0		+ 4·1
	Sep. 10..	8−07	27·0		− 8·9
		9−37	19·7		− 1·6
		10−32	14·0		+ 4·1
		1−32	8·1		+10·0
Indian Head...	Sep. 12...	1−56	19−28·4*E*	19−32·7*E*	+ 4·3
		4−33	32·0		+ 0·7
	Sep. 13...	8−01	38·5		− 5·8
		9−26	35·3		− 2·6
		10−31	31·8		+ 0·9
		1−31	25·1		+ 7·6
Balgonie......	Sep. 14...	1−43	18−50·9*E*	18−57·6*E*	+ 6·7
		4−18	54·0		+ 3·6
		8−03	63·9		− 6·3
		10−29	54·1		+ 3·5
		1−20	51·5		+ 6·1
Regina........	Sep. 16...	10−31	19−23·0*E*	19−26·8*E*	+ 3·8
		1−35	20·3		+ 6·5
		4−40	27·8		− 1·0
	Sep. 17...	7−52	33·0		− 6·2
		10−32	24·0		+ 2·8
		1−32	21·0		+ 5·8
Pense.........	Sep. 19...	7−45	19−52·5*E*	19−45·5*E*	− 7·0
		10−31	43·3		+ 2·2
		1−58	38·5		+ 7·0
		4−42	43·4		+ 2·1
Moosejaw.....	Sep. 20..	10−30	19−48·1*E*	19−52·9*E*	+ 4·8
		1−18	50·5		+ 2·4
		4−12	48·9		+ 4·0
	Sep. 21...	7−41	54·6		− 1·7
		10−24	50·0		+ 2·9
		1−23	51·7		+ 1·2
	Sep. 22...	7−30	56·6		− 3·7
		10−28	52·2		+ 0·7
		1−37	50·4		+ 2·5
		4−23	50·1		+ 2·8
	Sep. 23...	7−22	58·8		− 5·9
		10−29	50·5		+ 2·4
		1−32	47·5		+ 5·4

TABLE B.

HOURS IN LOCAL MEAN TIME.

Month	7-00	7-30	8-00	8-30	9-00	9-30	10-00	10-30	11-00	11-30	12-00	12-30	1-00	1-30	2-00	2-30	3-00	3-30	4-00	4-30	5-00	5-30	6-00	6-30	7-00
May....		- 8·7			- 3·3		1·1	3·0		6·5			7·6	7·6			5·8		4·5		2·5				
		- 6·2			- 6·1	- 4·3	- 2·0	- 1·2	1·3	3·5	4·6		5·1			7·3									
							0·3						6·0					4·8			1·8				
			- 6·1			- 4·5		- 0·2					6·2												
													10·0						2·7					- 0·2	
		- 6·8			- 0·8					4·9		3·7			4·2				4·2						
		- 6·3			- 3·3								7·5						0·9			- 3·9			
		- 6·3			- 6·9		- 1·8	2·3					4·9				8·0	4·4				- 0·1			
		- 6·7		- 2·7						6·9			9·6					5·7							
			- 8·9			- 3·6	- 1·6	1·5					5·7												
		- 6·6			- 3·2			2·1					6·3					6·3	1·3						
		- 5·9																							
		- 8·0			- 4·9		- 5·3			3·8			6·8					3·1							
		- 5·6		- 8·8		- 1·8		- 3·3					6·8												
June....		- 6·5			- 7·6		- 3·6	- 0·1	2·0	4·3				6·0				6·4			3·4				
		- 5·7	- 5·7		- 5·0	- 4·6	- 0·6							5·8				4·6							
			- 7·6										6·1												
		- 6·6				- 1·3	1·4	3·6	5·3	6·0			8·2				5·2								
		- 5·4				- 1·4	0.0	1·7					5·9						5·4						
			- 5·6		- 5·6			- 0·2						5·7					1·9						
			- 4·8					4·2					5·0	5·0					1·4						
			- 7·5										7·1												
			- 7·9					- 1·3						7·9					0·0						
		- 7·6	- 7·6			- 5·1		- 0·9						6·5					4·6	4·0					
			- 7·6					- 0·4		4·4	5·0		8·8												
			- 7·5			- 5·1		- 1·4						7·3						2·6					
			- 7·5					1·5					7·7												
July....		- 7·2				- 4·7		0·2		2·4	3·6			5·0						3·2					
			- 7·0			- 4·1	- 2·5	- 1·0	3·0					8·7											
														9·5					4·9		1·7				
		- 9·0						2·3						6·3											
		- 8·7				- 2·6		- 0·5						6·5				3·8							
			- 6·3					- 0·1						6·7						3·2					
		- 7·6	- 6·7	- 6·8		- 5·0		- 1·4							7·5										
			- 7·7				- 4·6	2·4						9·8	5·8						1·8				
		- 8·5				- 3·6		0·3			7·2				6·7	7·0				3·3					
		- 9·7																			4·3				
		- 8·5			- 6·5	- 4·3		0·6						8·6	8·6						3·5				
			10·4					- 1·8							9·1						4·9				
		- 7·3						- 1·9			2·6				8·7										

TABLE B.—*Concluded.*

HOURS IN LOCAL MEAN TIME.

Month	7-00	7-30	8-00	8-30	9-00	9-30	10-00	10-30	11-00	11-30	12-00	12-30	1-00	1-30	2-00	2-30	3-00	3-30	4-00	4-30	5-00	5-30	6-00	6-30	7-00
July....								0·7						8·6	8·6						6·1				
		− 7·4						− 2·1							6·2										
	− 6·2							0·8							6·3					5·9				4·9	
			− 6·2												7·6					3·4					
Aug....			− 6·4					− 0·6						6·2	6·3					3·5	2·6				
		− 9·1					2·3	3·4						10·7	10·7				6·0	5·6					
			− 9·1					− 1·0						10·0	8·2					2·4					
								− 1·4						8·8	8·8					3·4					
		− 6·9						− 3·2						5·0											
														8·1						5·3					
		− 7·6						− 1·0						7·1											
								3·0						6·0											
			− 7·9					1·7						10·0											
			− 8·7					1·4							8·7					5·8					
		− 7·6	− 7·6											7·7						4·0					
			− 8·1					3·2																	
		− 8·1						0·0						10·4							5·9				
			−10·0					1·0						7·5											
		− 7·0												7·4											
		− 6·7	− 6·4					− 0·1						5·3						3·2					
														6·8											
		− 6·3	− 5·6					− 1·9						5·9											
														6·5											
Sep.....		− 8·1						2·9						6·4											
		− 7·1						2·0						8·6											
		− 7·6						1·4						6·9					0·5						
		− 6·2	− 6·2					0·1						6·8				1·8							
		− 7·9																		4·1					
			− 8·9			− 2·0		4·1						10·0											
															4·3					0·7					
			− 5·8			− 2·6		0·9						7·6											
			− 6·3					3·5						6·1											
														6·7					3·6						
								3·8						6·5						1·0					
			− 6·2					2·8						5·8											
		− 7·0	− 7·0					2·2							7·0					2·1					
		− 5·9						2·4						5·4											
Mean...	− 6·2	− 7·2	− 7·3	− 6·1	− 4·8	− 3·6	− 1·3	+0·6	2·9	4·7	4·6	3·7	6·9	7·3	7·5	7·2	6·3	4·5	3·0	3·4	3·5	− 2·0	....	2·3	....
No. of Obs.	1	39	33	3	11	17	13	50	4	9	6	1	19	45	18	2	3	9	14	19	11	2		2	

The mean value for each hour and half-hour is given at the foot of the corresponding column, the small figures underneath indicating the number of observations from which the mean value was determined. Owing to the range of declination at Middleton and Dryden being rather large, the results at these places were left out of consideration.

At least two observations were taken for dip, one in the morning and one in the afternoon. In case the number of morning and number of afternoon observations differed, the mean of the morning was always combined with the mean of the afternoon values. The horizontal force was obtained from a complete set (oscillations and deflections) both in the morning and afternoon, the mean of the morning being always taken as one observation, the mean of the afternoon values as one, in case there were not the same number of each.

A complete day's observations consisted of the following, and in the order named: Declination (elongation), azimuth, declination, dip, declination, deflections, oscillations, latitude, declination (elongation), oscillations, deflections, azimuth, dip and declination. Frequently, when no astronomical observations were necessary, one or two extra observations for declination were taken. At a number of stations, two complete days' observations were taken.

Before commencing, and after completing the field work for the season, observations were made at the Magnetic Observatory at Agincourt, Ont., for comparing the field instruments with the standard instruments. The following table gives the corrections that were applied to the observed values, not only for the season 1910, but also for the two preceding seasons 1909 and 1908; also the value of log P where P is a constant depending on the distribution of the magnetism in the intensity magnet.

Year.	Tesdorpf 1977		Dover 145.		Tesdorpf 1977 Log P.		Remarks.
	Corr. Decl.	Corr. Hor. Int.	Needle.	Corr. Dip.	Short Dist.	Long Dist.	
1908	+3′·2	−·00061H	....	......	....	....	
1909	+1′·8	−·00104H	No. 1 & 2	−′·5	9·99106	9·99475	
1910	+3′·6	−·00128H	No. 1	−′·8	9·99178	9·99541	Log P, determined from 31 observations, distributed over the entire season.
			No. 2	−′·2			

Note:—Western declination reckoned negative, eastern declination positive.

During the season, 48 stations, lying between Chapleau, Ont., and Moosejaw, Sask., were occupied. Below is given a summary of the work done at each station.

Station.	Date.	No. of Observations for				Remarks.
		Declination.		Dip.	Hor. Int.	
		E. Elong.	W. Elong.			
Chapleau..........	May 7, 9...	2	2	2	4	Relocation of the Carnegie Institution station of 1906. Needle steady. Auroral display on night of 9th.
Wayland..........	May 10-11	1	2	3	4	Weather cold and cloudy. Needle steady. Astronomical observations not completed until May 13.
Missinaibi.........	May 14-16	1	2	4	3	The greatest westerly declination recorded on the 16th occurred about 11 a.m.; not much change for about 5 hours following.
Grasett...........	May 19-20	2	2	3	2	Disturbance on May 18. Needle slightly disturbed on 19th. Declination observations taken during the disturbance on May 18, on which day Halley's comet was nearest the earth, are given below. See p. 65.
White River.......	May 23-25	2	2	4	2	Approximately, a relocation of the Carnegie Institution station of 1906, but, owing to the removal of reference points, it was impossible to be sure of the precise point. Observing was discontinued on May 24, owing to a slight disturbance.
Montizambert.....	May 27-28	2	1	2	2	Faint aurora on night of May 26. Needle slightly unsteady on morning of 27th and again on morning of 28th; however, no observations were discarded.
Heron Bay........	May 30-31	2	2	4	4	Cloudy with snow on 30th; rained nearly all day of 31st, and needle slightly unsteady. Unable to complete the astronomical observations until June 3.

Station.	Date.	No. of Observations for				Remarks.
		Declination.		Dip.	Hor. Int.	
		E. Elong.	W. Elong.			
Middleton.........	June 4.....	1	1	2	2	Considerable local attraction. Range of declination, 19'.6, and dip was 80°20'. Sample of rock taken from cliff near station deflected the needle.
Schreiber.........	June 7-8...	1	1	2	4	Weather fine. Needle remained practically stationary for about two hours on morning of the 7th, and for about same length of time at noon. Disturbance on morning of 8th, so discarded the declination observations.
Gravel............	June 9-10..	1	1	3	2	Worked only part of the 9th owing to a disturbance.
Nipigon...........	June 11-13.	2	2	4	4	Observed about 15 feet southerly from the Carnegie Institution station of 1906. Weather conditions good for observing.
Dorion............	June 14.....	1	1	2	2	Only one day spent at Dorion. Needle steady.
Mackenzie........	June 15....	1	1	2	2	Only one day spent at Mackenzie.
Fort William......	June 17-18.	2	2	4	4	Needle slightly unsteady, probably due to the electric car line which is about ¼ mile to the east.
Kaministikwia....	June 21-22.	1	1	2	2	Discontinued observing on 21st, owing to a disturbance.
Raith............	June 23-25.	2	2	3	2	Weather conditions good for observing. Needle steady.
Savanne...........	June 27-28.	2	2	4	4	Approximately, a relocation of the Carnegie Institution station of 1906. Needle steady.
Niblock...........	June 30-July 1...	2	2	3	3	Smoky owing to bush fires.
Martin............	July 2-4....	2	2	3	4	The Western elongation about 3'·7 less on July 4th than it was on July 2nd; needle somewhat unsteady at noon on 4th.

Station.	Date.	No. of Observations for				Remarks.
		Declination.		Dip.	Hor.Int.	
		E. Elong.	W. Elong.			
Ignace............	July 6-8....	3	3	4	4	Discarded observation of July 5th, owing to a disturbance. Slight disturbance on July 7th. Thunder storms on 6th and 7th.
Taché............	July 11-12..	2	2	4	4	No astronomical observations, except latitude obtained on the 11th, owing to clouds and showers. Thunder and hail storm about noon on the 12th, and unsettled during most of the afternoon.
Wabigoon.........	July 13-14..	1	2	3	3	Conditions on both days satisfactory for observing.
Dryden...........	July 16-17..	2	2	2	2	Judging from the results obtained here there is apparently considerable local attraction, although the surface conditions do not indicate it.
Eagle............	July 18-20..	2	2	2	2	Approximately, a relocation of the Carnegie Institution station of 1906. Conditions favourable for observing.
Vermilion.........	July 21.....	1	1	2	2	Completed the work in one day. Needle steady.
Hawk Lake.......	July 23-24..	2	2	4	4	Weather conditions not very favourable; otherwise everything was quite satisfactory.
Kenora...........	July 26-27..	1	2	2	4	Re-occupied the Carnegie Institution station of 1906. Apparently favourable conditions, though there is a good deal of rock in the vicinity.
Kalmar...........	July 28-29	1	1	2	2	Had difficulty in locating a suitable place for observing, owing to the uneven nature of the locality, which is, for the most part, covered with small trees.
Rennie...........	July 29-30..	2	2	3	3	Conditions favourable for observing.

Station.	Date.	No. of Observations for				Remarks.
		Declination.		Dip.	Hor.Int.	
		E. Elong.	W. Elong.			
Whitemouth.......	Aug. 1–2...	1	2	2	3	The needle manifested a slight unsteadiness on Aug. 1st and 2nd, though the variation during the day seems quite regular. The range is rather large, being 18′.2. Observed for declination on Aug. 3rd, but discarded the results, as there was a marked disturbance.
Norquay..........	Aug. 4–5...	1	2	3	3	There was no apparent disturbance at the time of observing, though the range seems rather large, being 18′.2.
Winnipeg..........	Aug. 8–9...	1	2	3	4	The station is a relocation of the Carnegie Institution station of 1906. Point is marked by a stone pier marked 'C. I. 1908.' The needle showed signs of unsteadiness. There was an auroral display on the 9th.
Marquette........	Aug. 11–12	1	2	2	2	Conditions favourable for observing.
Portage-la-Prairie.	Aug. 15–16.	1	2	2	4	Thunder storms on afternoon and evening of the 15th; otherwise, conditions were favourable.
McGregor.........	Aug. 17–18.	1	1	2	2	Needle slightly unsteady on the morning of the 18th.
Carberry.........	Aug. 19–20.	2	2	4	4	Needle slightly unsteady Aug. 19.
Brandon..........	Aug. 23–25.	3	3	4	4	Was unable to occupy the Carnegie Institution station of 1906, owing to the erection of buildings in the vicinity. Located on the Experimental Farm. Was unable to complete the astronomical work until the 25th.
Griswold..........	Aug. 26....	2	2	2	2	Completed the work in one day.
Virden............	Aug. 27–28	2	1	2	2	Slight unsteadiness of the needle on the 28th. Took an eastern elongation on the 29th, but a disturbance apparently existed.

Station.	Date.	No. of Observations for				Remarks.
		Declination.		Dip.	Hor.Int.	
		E. Elong.	W. Elong.			
Kirkella...........	Aug. 30–31	1	2	2	3	The station is approximately a relocation of the Carnegie Institution station of 1906. Range only 11′·2.
Wapella...........	Sep. 1–2....	2	2	4	4	Rained most of day of 1st. Fine and warm on 2nd.
Broadview........	Sep. 3–5....	2	2	4	4	Station approximately a relocation of the Carnegie Institution station of 1906. Unable to complete the astronomical work until Sept. 8th, owing to bad weather.
Wolseley..........	Sep. 9–10...	1	2	2	2	Slight disturbance on morning of 10th, and cold and windy during day.
Indian Head......	Sep. 12–13.	1	2	2	2	Located on the Experimental Farm. Unable to find a place where it was possible to take the bearings of a number of well-defined objects, owing to the level nature of the land, and the trees surrounding the fields. Needle slightly disturbed on morning of the 13th.
Balgonie..........	Sep. 14–15..	1	2	2	3	Conditions favourable for work.
Regina............	Sep. 16–17..	1	2	2	4	Unable to occupy the Carnegie Institution station of 1906. Located about one-fourth of a mile in a south-westerly direction, on the jail grounds. No apparent disturbance, though there was only about 3′ change in declination between 10–30 and the western elongation. Observations on the two days are concordant.
Pense.............	Sep. 19....	1	1	2	2	Completed the work in one day, conditions being quite favourable.
Moosejaw.........	Sep. 20–23..	3	4	4	4	Disturbance, though slight, on 20th, 21st and 22nd. Range on 21st, 22nd and 23rd was 6′.5, 6′.2, and 11′.3, respectively.

OBSERVATIONS for Declination, taken at Grasett, Ont., on May 18, 1910, preceding, during, and following the computed passage of Halley's Comet.

75th Mer. Time.	Declination.	Temp.	Remarks.
h. m	° ′		
7 25 a.m.	3 56·8 W. of N.	....	Snowing.
30 "	56·8 "	....	
35 "	4 2·6 "	....	
40 "	2·6 "	....	
43 "	4·4 "	....	
45 "	4·4 "	....	
46 "	4·2 "	....	
48 "	3·6 "	....	
50 "	4·4 "	....	
55 "	4·6 "	....	
8 00 "	7·0 "	....	
05 "	7·8 "	....	
9 35 "	2·8 "	....	
36 "	2·2 "	....	
37 "	1·4 "	....	
40 "	3 59·2 "	....	
45 "	59·2 "	....	
50 "	58·6 "	....	
55 "	4 3·0 "	....	
10 00 "	3·2 "	....	
05 "	4·4 "	....	
10 "	5·2 "	....	
15 "	5·6 "	....	
20 "	8·6 "	....	
25 "	13·2 "	....	
30 "	13·8 "	....	
35 "	15·0 "	....	
40 "	16·2 "	....	
45 "	11·0 "	....	
50 "	11·4 "	....	
55 "	12·4 "	....	
11 00 "	16·4 "	....	
15 "	12·4 "	....	
20 "	10·8 "	....	
25 "	10·6 "	....	
30 "	8·8 "	....	
35 "	10·4 "	....	
1 30 p.m.	00·4 "	....	
35 "	3 59·2 "	....	
40 "	56·4 "	....	
45 "	56·8 "	....	
50 "	56·8 "	....	
2 05 "	55·0 "	58°·0 *F*	
15 "	54·4 "	....	
20 "	52·6 "	....	
30 "	55·8 "	....	
35 "	54·4 "	....	
40 "	53·2 "	56°·0 *F*	
50 "	54·4 "	....	
3 00 "	52·4 "	....	
15 "	47·4 "	....	
25 "	48·8 "	....	
50 "	50·4 "	....	
4 00 "	49·2 "	....	
50 "	48·8 "	....	
5 00 "	46·0 "	52°·0 *F*	
40 "	46·8 "	....	

OBSERVATIONS for Declination, taken at Grasett, Ont., on May 18, 1910, preceding, during, and following the computed passage of Halley's Comet.—*Con.*

75th Mer. Time.	Declination.	Temp.	Remarks.
h. m.	° ′		
6 10 p.m.	3 48·8 W. of N.	52°·0 *F*	
20 "	47·2 "	....	
30 "	47·8 "	....	
40 "	45·4 "	....	
7 25 "	45·2 "	46°.0 *F*	Clouds and showers.
35 "	42·2 "	....	
40 "	43·2 "	....	
45 "	39·2 "	....	
50 "	47·0 "	....	
55 "	43·4 "	....	
8 00 "	43·2 "	....	
05 "	43·2 "	....	
10 "	43·2 "	....	
20 "	49·2 "	....	
25 "	56·4 "	....	
30 "	54·2 "	46°·0 *F*	Clouds.
35 "	54·8 "	....	Showers.
40 "	49·6 "	....	
45 "	48·4 "	....	
50 "	49·4 "	44°·0 *F*	
55 "	50·6 "	....	
9 00 "	47·6 "	....	Clouds.
05 "	46·4 "	....	
10 "	43·4 "	....	
15 "	45·2 "	....	
20 "	36·4 "	....	
25 "	39·0 "	....	
30 "	32·2 "	....	
35 "	35·4 "	....	
40 "	39·0 "	....	
45 "	37·2 "	42°·0 *F*	
50 "	38·4 "	....	
10 00 "	38·8 "	....	
05 "	35·2 "	....	
10 "	36·8 "	....	
15 "	39·8 "	....	
20 "	28·4 "	....	
22 "	52·6 "	....	
24 "	4 2·8 "	....	
26 "	10·8 "	....	
30 "	8·2 "	....	
35 "	10·0 "	....	Cloudy and showery during the night, but rifts in the clouds revealed what appeared to be an auroral display.
40 "	3 54·4 "	....	
45 "	52·2 "	44°·0 *F*	
50 "	55·0 "	....	
55 "	4 01·2 "	....	
11 00 "	01·2 "	....	
05 "	01·2 "	....	
10 "	3·0 "	....	
15 "	8·2 "	....	
20 "	3 58·2 "	....	
25 "	4 3·0 "	....	
30 "	3 53·6 "	....	
35 "	52·8 "	....	
40 "	45·2 "	....	
45 "	39·2 "	....	
50 "	29·4 "	38°·0 *F*	

AGINCOURT.

(Base station)

Month	Declination.			Inclination.			Horizontal Intensity.		
	1906.	1910.	Diff. 06–10	1906.	1910.	Diff. 06–10.	1906.	1910.	Diff. 06–10.
	° ′	° ′	′	° ′	° ′	′			
Jan.........	−5 42·8	−6 01·7	18·9	74 35·0	74 38·4	−3·4	·164031	·162860	·00117
Feb.........	43·3	1·7	18·4	35·0	38·3	−3·3	·163971	·162860	·00111
March......	43·5	2·5	19·0	35·3	38·6	−3·3	·163988	·162755	·00123
April.......	43·9	3·0	19·1	35·7	38·4	−2·7	·164074	·162667	·00140
May........	43·7	3·1	19·4	34·3	38·3	−4·0	·164051	·162750	·00130
June........	43·6	3·5	19·9	34·3	37·2	−2·9	·164061	·162840	·00122
July........	44·6	3·7	19·1	34·3	37·8	−3·5	·164056	·162790	·00127
August......	47·3	4·7	17·4	33·1	38·5	−5·4	·163960	·162630	·00133
Sep.........	47·3	5·1	17·8	35·9	38·8	−2·9	·163884	·162610	·00127
Oct.........	47·5	5·4	17·9	36·5	39·4	−2·9	·163857	·162440	·00142
Nov........	47·7	6·1	18·4	35·3	38·8	−3·5	·163887	·162490	·00140
Dec.........	48·9	6·1	17·2	35·5	39·0	−3·5	·163833	·162480	·00135

Results for 1906 taken from Meteorological Service Report for 1906; and results for 1910 taken from the Journal of the Royal Astronomical Society of Canada for 1910.

Description of Magnetic Stations occupied by C. A. French in 1910.

Chapleau, Ont.—The station is a relocation of the Carnegie Institution station. It is near the river bank on the east side of the town, just at the end of the street, lying between the Protestant and Catholic cemeteries. It is 60 feet southeast of the southeast corner of the Protestant cemetery, and 59 feet northeast of the northeast corner of the Catholic cemetery. True bearings of the following points were determined:—

Pole on Algoma hotel, 72° 31′.3 west of south.
Pole on water-tank (R.O.), 73° 21′.1 west of south.

Wayland, Ont.—The station is 244 feet southwesterly from the southwesterly corner of the C. P. R. depot. From the station, all of the depot, except the southerly end, is hidden from view by a large boulder, which is about 94 feet distant in a northeasterly direction. A stake, 2 inches in diameter, and projecting 15 inches above ground, marks the point. True bearings of the following points were determined:—

Chimney on C. P. R. water-tank (R.O.), 19° 14′.2 east of north.
South gable of C. P. R. depot, 41° 57′.8 east of north.

Missinaibi, Ont.—The station is approximately a relocation of the Carnegie Institution station of 1906. It is about one-fourth of a mile west of the old Hudson's Bay Company's post and about 400 feet south of the railroad. From the station the C. P. R. pump-house and tank may be seen slightly to the west of the centre of

the top of the Hudson's Bay Company's new store. The point is 56 feet from the southeasterly corner and 49.5 feet from the southwesterly corner of the Episcopal church. True bearings of the following points were determined:—

Chimney on C. P. R. Co.'s water-tank (R.O.), 24° 29'.9 west of north.

Pole on school, 2° 36'.2 west of north.

Southeasterly corner of Hudson's Bay Co.'s store, 19° 8'.5 west of north.

The point is marked by a stake, 2 inches in diameter, and 6 inches above ground.

Grasett, Ont.—The station is in a small clearing northeast of the C. P. R. depot. It is 366 feet northeast of the northeast corner of the section-house on the south side of the C. P. R. tracks. The line joining the station with the corner of the section-house intersects the track 72 feet from the house. The point is marked by a stake, 3 by 3 inches, and projecting 2 inches above ground. True bearings of the following points were determined:—

Pole on east end of south section-house, 136° 26'.5 west of north.

Pole on west end of south section-house, 133° 53'.3 west of north.

Gable of north end of north section-house, 122° 26'.3 west of north.

White River, Ont.—The station is probably within 20 feet of the Carnegie Institution station. It is 110.5 feet east of the Y. M. C. A. building and slightly to the north of a line extending from, and at right angles to, the middle of the eastern side of the building. It is 152.5 feet southeasterly from the southeast corner of the main part of the Methodist church. The tip of the pole on the C. P. R. water-tank may be seen over the east gable of the school, and also over a building used as a dwelling-house and pool-room. True bearings of the following points were determined:—

Tip of ventilator on C. P. R. roundhouse, 63° 5'.4 west of north.

Tip of pole on C. P. R. water-tank, 52° 14'.4 west of north.

Chimney on English church, 22° 4'.5 west of north.

Spire on Catholic church (R.O.), 17° 28'.4 west of north.

The point is marked by a stake, 2 inches by 3 inches, projecting 3 inches above ground.

Montizambert, Ont.—The station is on a clearing, northwest of the C. P. R. depot, being 540 feet westerly from the depot, 165 feet north of the C. P. R. tracks, and 90 feet south of the White river. The east end of the section-house, on the south side of the track, may be seen to the east of a log building, which is distant 51 feet from the station. True bearings of the following points were determined:—

West gable of C. P. R. depot (R.O.), 52° 7'.9 east of north.

East gable of C. P. R. section-house, 133° 55'.1 east of north.

The point is marked by a stake, 2 inches in diameter, and projecting 2 inches above ground.

Heron Bay, Ont.—The station is in a field lying to the northwest of the C. P. R. depot. It is about 325 feet north of the C. P. R. tracks, and is in line with, and 40 feet north of, the end of a fence, which, if continued in a southerly direction, would pass about 20 feet west of the depot. About 30 feet south of the station is a ridge of rock extending 40 feet in an easterly and westerly direction. The point

is marked by a stake, 2 inches by 4 inches, and projecting 3 inches above ground. True bearings of the following points were determined:—

North gable of Begg's house and store, 119° 12′.8 east of north.
West gable of C. P. R. depot, 155° 00′.9 east of north.
North gable of Miller's store (R.O.), 172° 22′.1 east of north.

Middleton, Ont.—The station is about 450 feet south of the C. P. R. tracks, and 75 feet north of the edge of a gravel beach on Lake Superior. It is 35 feet west of a rocky bluff and 12 feet north of an excavation. To the west, about 12 feet and beyond, the soil consists, for the most part, of stones and coarse gravel. The point is marked by a stake, 3 inches in diameter, and projecting 1 inch above ground. True bearings of the following points were determined:—

Top of second telegraph pole west of C. P. R. depot, 2° 26′.1 east of north.
West gable of C. P. R. depot (R. O.), 34° 23′.1 east of north.
East gable of C. P. R. depot, 38° 9′.1 east of north.

A piece of rock taken from the bluff to the east of the station showed marked magnetic action.

Schreiber, Ont.—The station is a relocation of the Carnegie Institution station of 1906. It is in an open field about one-third of a mile east of the town, near the cemetery, being 100 feet from the southwest corner, and directly in line with the picket fence on the south side. It is one-quarter of a mile east of the railroad. True bearings of the following points were determined:—

Tip of ventilator on C. P. R. shops, 12° 47′.7 west of south.
Tip of pole on C. P. R. water-tank (R.O.), 28° 56′.3 west of south.
Spire on Presbyterian church, 56° 24′.5 west of south.
East gable of Y. M. C. A. building, 78° 2′.5 west of south.
Tip of belfry on school, 85° 19′.5 west of north.

Gravel, Ont.—The station is at the summit of a slope, 224 feet north of the C. P. R. tracks. It is in line with the east side, and 182 feet from the northeast corner of the C. P. R. depot. It is 97 feet northwest of the northwest corner of a small red house, belonging to Mr. Roy. True bearings of the following points were determined:—

East gable of C. P. R. depot, 34° 9′.8 west of south.
Top of pole on C. P. R. water-tank (R.O.), 78° 55′.4 west of north.

A stake, 2 inches in diameter and projecting 4 inches above ground, marks the point.

Nipigon, Ont.—The station is approximately 11.5 feet south and 5 feet west of the Carnegie Institution station of 1906. It is in the northeastern part of the town, about 400 feet east of the C. P. R. tracks. It is 11.5 feet south of the fence along the north side of the street running from the C. P. R. water-tank eastward to the river, and 17 feet from the bank of the river. True bearings of the following points were determined:—

Spire on Presbyterian church, 142° 40′.1 west of north.
Top of pole on Hudson's Bay Co's store, 118° 52′.1 west of north.
Spire on C. P. R. water-tank, 88° 35′.2 west of north.

Dorion, Ont.—The station is in an open field, north of the C. P. R. tracks and depot. It is 190 feet north of the fence on the south side of the field which is adjacent to the C. P. R., and 84 feet east of the middle of the road which crosses the field. True bearings of the following points were determined:—

South gable of Mr. Kohler's stable, 32° 50'.7 west of north.

South gable of house on farm lying to north of Mr. Kohler's, 28° 28'.8 west of north.

South gable of Mr. Kohler's house, 22° 51'.4 west of north.

Mackenzie, Ont.—The station is on a small clearing northwest of the C. P. R. depot. It is 263 feet north of the tracks, and is in line with the west end of the section-house, being 228 feet from the northwest corner of the main part of the building. True bearings of the following points were determined:—

West gable of C. P. R. depot, 125° 59'.3 east of north.

East pole on section-house, 155° 30'.0 east of north.

West pole on section-house (R.O.), 161° 2'.8 east of north.

Tip of pipe on C. P. R. water-tank, 176° 56'.8 east of north.

Fort William, Ont.—The station is in an open field, lying north of Leith street and west of Archibald street. It is 22 feet west of the west side of Archibald street, and is north of, and in line with, the east end of the 'Arena,' being 96.5 feet north of the fence on the north side of the enclosure surrounding the building. True bearings of the following points were determined:—

Bottom of flagstaff on school, 3° 41'.2 east of north.

Pole on C. P. R. elevator B, 40° 0'.1 east of north.

Top of pole on Central school, 140° 55'.3 east of north.

Top of pole on City hall (R.O.), 160° 1'.8 east of north.

Top of pole on the 'Arena,' 0° 6'.6 west of south.

Kaministikwia, Ont.—The station is about 380 feet north of the C. P. R. tracks. It is almost in line with the easterly end, and is 99 feet southerly from the southeasterly corner of a log house on the west side of the road, and further, is 109 feet southwesterly from the southwest corner of another log house on the east side of the road. These are the only houses in the immediate vicinity.

The point is marked by a stake, 2 by 3 inches, and projecting 2 inches above ground. True bearings of the following points were determined:—

West gable of C. P. R. freight-shed, 59° 18'.2 west of south.

Northwest corner of C. P. R. depot, 74° 39'.0 west of south.

Top of pole on C. P. R. water-tank (R.O.), 64° 28'.4 west of north.

Raith, Ont.—The station is 150 feet north of the Grand Trunk Pacific railway. It is in line with the south side of Mr. Johnson's house, and 240 feet east of the southeast corner.

A stake, 2 by 4 inches, and 1 inch above ground, marks the point. True bearings of the following points were determined:—

Top of pole on C. P. R. water-tank, 78° 13'.6 west of south.

East gable of C. P. R. depot, 75° 17'.4 west of north.

Top of pole on G. T. P. water-tank (R.O.), 64° 37'.1 west of north.

East gable of C. P. R. section-house, 54° 56'.0 west of north.

Savanne, Ont.—This is approximately a relocation of the Carnegie Institution station of 1906. The station is near the Savanne river, about one-quarter of a mile south of the C. P. R. tracks. It is about 54 feet north of the bank of the river, in a path which leads south from the railroad, leaving the railroad at a point 800 feet east of the depot. There is a telegraph pole about 20 feet west of the continuation of a line joining the station and the pole on the Hudson's Bay Company's store (now vacated). The point is marked by a stake, 3 inches in diameter, and projecting 3 inches above ground. True bearing of the following point was determined:—

Pole on Hudson's Bay Company's store, 24° 30′.1 east of north.

Niblock, Ont.—The station is on a small clearing southwest of the C. P. R. depot, being on the summit of a small ridge which runs in an easterly and westerly direction. It is 270 feet southwesterly from the southwest corner of the main part of the depot. The point is marked by a stake, 2 inches in diameter, and projecting 3 inches above ground. True bearings of the following points were obtained:—

South gable of small car-house west of depot (R.O.), 7° 21′.1 east of north.

Southwest corner of main part of C. P. R. depot, 62° 7′.8 east of south.

Martin, Ont.—The station is near the northeasterly corner of a field surrounding the section-house, being 17 feet from the fence on the northerly side and 24 feet from the fence on the easterly side of field. It is 226 feet in a northerly direction from the C. P. R. tracks, and 206 feet northeasterly from the northeast corner of the section-house. A stake, 2 inches in diameter and projecting 3 inches above ground, marks the point.

The east gable of the section-house bears 76° 18′.2 east of north.

Ignace, Ont.—The station is approximately a relocation of the Carnegie Institution station of 1906. It is in an open field, about 500 feet south of the C. P. R. tracks and about 600 feet southeast of the C. P. R. roundhouse. It is 208 feet east of the east side of the first street east of the Y. M. C. A. building, and 52 ft. north of the fence on the south side of the field. True bearings of the following points were determined:—

Tip of pole on C. P. R. water-tank, 61° 15′.8 west of north.

Tip of pole on Y. M. C. A. building (Ignace hotel) (R.O.), 35° 18′.9 west of north.

East gable of store, 26° 30′.1 west of north.

Taché, Ont.—The station is east of the river, and 260 feet south of the C. P. R. tracks. It is about 12 feet east of a point which is in line with the east end of the railway bridge over the river, 18 feet from the edge of a small ravine on the west, and 15 feet from the edge of one on the south. The point is marked by a stake, 2 inches in diameter, and projecting 3 inches above ground. True bearings of the following points were determined:—

East gable of C. P. R. depot (R. O.), 16° 24′.9 west of north.

Top of pipe on chimney of C. P. R. depot, 16° 6′.2 west of north.

Tip of pole on C. P. R. water-tank, 6° 25′.8 east of north.

South gable of car-house, 61° 22′.7 east of north.

Wabigoon, Ont.—The station is 34 feet south of the foot of a ridge of rock which terminates Stanley avenue at its northerly end, and is in line with the fence on the easterly side of the street. The point is marked by a stake, 2 inches by 3 inches, projecting 3 inches above ground. True bearings of the following points were determined.

Top of cross on English church, 44° 51′.7 east of south.

Pole on Imperial hotel (R.O.), 28° 54′.9 east of south.

Gable of house on southerly side of bay, 16° 44′.5 west of south.

Dryden, Ont.—The station is about ¼ of a mile northeast of the town on the east side of the Wabigoon river. It is on an unused portion of the Government road which runs from the river into the country in a northeasterly direction, and is about midway between the river and the end of Florence street, which intersects the road at right angles. The road leading from the town meets the main road where the latter and Florence street intersect. The pole on the C. P. R. water-tank may be seen about midway between the cross on the English church and the pole on the Central hotel. The point is 34 feet from the southerly side of the Government road and 290 feet from the northeasterly corner formed by the intersection of Florence street and the Government road. The point is marked by a 3 by 3-inch stake, projecting 2 inches above ground. True bearings of the following points were determined:—

North chimney on Mr. Swanson's house, 99° 32′.3 east of north.

Cross on English church, 121° 51′.4 east of north.

Pole on C. P. R. water-tank (R. O.), 123° 00′.0 east of north.

Eagle, Ont.—The station is approximately a relocation of the Carnegie Institution of 1906. It is about ¼ of a mile east of the C. P. R. depot (moved since 1906), and about 500 feet south of the C. P. R. tracks. A line, which is a continuation of the east side of Mr. J. A. Gardiner's house (formerly the Central hotel) in a southerly direction, intersects a line joining the station and pole on the C. P. R. water-tank, 177 feet from the southeast corner of the house and 64 feet westerly from the station. True bearings of the following points were determined:—

Top of pole on C. P. R. water-tank (R. O.), 74° 33′.8 west of south.

East gable of C. P. R. depot, 77° 24′.5 west of south.

Bottom of pole on 'Blue' store, 74° 37′.4 west of north.

Left edge of chimney on Mrs. Mitchell's house, 60° 55′.9 west of north.

East gable of Mrs. Mitchell's house, 58° 27′.5 west of north.

Vermilion, Ont.—The station is north of the C. P. R. tracks about 400 feet. It is 6 feet west of being in line with the west side of the Grand Trunk house, and is 158 feet north of the northwest corner of the main part of the building. It is 30 feet west of being in line with the west side of the C. P. R. depot, and is 288 feet north of the fence on the north side of the C. P. R. yard. A stake, 2 by 2 inches, and 2 inches above ground, marks the precise point. True bearings of the following points were determined:—

East gable of freight-shed, west of C. P. R. tank (R. O.), 34° 52′.5 west of south.

Top of pole on C. P. R. water-tank, 24° 43′.3 west of south.

East gable of C. P. R. depot, 14° 0′.9 east of south.

Hawk Lake, Ont.—The station is located on a clearing slightly to the west of south from the C. P. R. depot, and about 300 feet south of the C. P. R. tracks. It is 25 feet from the shore of the lake and 100 feet southwesterly from a rocky beach, exposed part of the rock being about 20 feet in width. The central portion of this part of the beach is in line with the west end of the C. P. R. depot. The point is marked by a stake, 2 inches in diameter, and projects 4 inches above ground. True bearings of the following points were determined:—

West gable of C. P. R. depot (R.O.), 9° 40′.4 west of north.
East gable of C. P. R. depot, 1° 27′.2 west of north.
First telegraph pole east of C. P. R. depot, 6° 52′.2 east of north.

Kenora, Ont.—The station is approximately a relocation of the Carnegie Institution station of 1906. The point is west of and slightly to the north of being in line with the front of Mr. Wilson's house. It is 58 feet west of the fence along the west side of Mr. Wilson's lot, and 16 feet north of the north side of Park street (East Third street). True bearings of the following points were determined:—

Spire on Knox church (R. O.), 67° 24′.0 west of south.
Pole on Central school, 84° 43′.4 west of north.
Spire on Episcopal church, 78° 7′.1 west of north.
Spire on Catholic church, 74° 38′.6 west of north.

Kalmar, Ont.—The station is on a level portion of ground near the summit of a slope lying to the east of the western section-house. It is reached by a path, which leaves the C. P. R. tracks at a point about 50 feet east of the section-house. It is about 245 feet north of the tracks, and about 300 feet northeast of the northeast corner of the house. The point is marked by a stake, 2 inches in diameter, and projecting 1 foot above ground. A mound of stones surrounds the stake.

The east gable of the section-house bears 57° 30′.1 west of south.

Rennie, Man.—The station is on the property of Mr. Shepherd. It is about 300 feet northeast of the C. P. R. depot, being near the southeast corner of the second enclosure, east of the C. P. R. tracks. It is 33 feet north of the fence on the south, and 90 feet west of the fence on the east side of the enclosure. A stake, 3 inches in diameter and 6 inches above ground, marks the precise point. True bearings of the following points were determined:—

Top of pole on C. P. R. water-tank (R. O.), 56° 21′.1 east of south.
Left edge of east chimney on C. P. R. depot, 52° 38′.1 west of south.

Whitemouth, Man.—The station is northeast of the C. P. R. depot, and about 600 feet north of the C. P. R. tracks, being on property belonging to Mr. McKinley. It is at the summit of a slope adjacent to the river, and is 15 feet north of the fence which marks the northerly limit of the first enclosure north of the main street of the village. It is 75 feet west of a gate which is on the west side of a lane running from the main street to the river; 140 feet northeast of a church, and about 225 feet west of the C. P. R. pump-house. A stake, 2 inches in diameter and 4 inches above ground, marks the precise point. True bearings of the following points were determined:—

Top of pole on C. P. R. water-tank (R. O.), 35° 34′.0 west of south.
Pole on east end of C. P. R. depot, 53° 41′.4 west of south.

Norquay, Man.—The station is in an open field belonging to Mr. Black. It is 360 feet south of the south limit of the C. P. R. right-of-way, and 140 feet east of the west limit of the Government road allowance. A squatter's house is about 100 feet northwesterly from the station. True bearings of the following points were determined:—

East gable of section-house (R. O.), 26° 16′.0 west of north.

West gable of C. P. R. depot, 4° 1′.6 east of north.

Winnipeg, Man.—The station is a relocation of the Carnegie Institution station of 1906. A stone pier, marked 'C. I., 1908,' represents the precise point. It is in River park, about one-half mile east of the park entrance, in the first cleared space beyond the grove of small trees that surround the entrance. It is about 45 feet from the top of the north bank of the Red river, and in line with the fence bounding the buffalo pasture on the side adjacent to the river. It is about 330 feet southwest of the south corner of the pasture. Two grain elevators in the distance, and a small red barn in the pasture, are seen nearly in line from the station. A red water-tank is seen near the elevators and a little to the west of the barn. The following true bearings were determined:—

Pole on red water-tank (R. O.), 23° 36′.9 east of north.

Smoke-stack near International elevator, 39° 17′.1 east of north.

West gable of large white house, 47° 25′.9 east of north.

Marquette, Man.—The station is about 300 feet southwesterly from Mr. Smith's store, and about 500 feet south of the C. P. R. tracks. It is 76 feet east of the middle of a north-south road, 161 feet north of the middle of the east-west road, and 169 feet southwest of the southwest corner of a red barn. Mr. Smith's store appears midway between the west end of the C. P. R. depot and the east end of the C. P. R. section-house. A stake, 2 inches in diameter and 3 inches above ground, marks the point. True bearings of the following points were determined:—

West gable of C. P. R. freight-shed, 45° 57′.9 east of north.

West gable of C. P. R. depot, 49° 15′.5 east of north.

East gable of C. P. R. section-house, 64° 4′.7 east of north.

Pole on west end of Mr. Brown's stable (R.O.), 121° 37′.2 east of north.

Portage-la-Prairie, Man.—The station is on the grounds of the Agricultural Association, near the east end of the enclosure, which is inside the race-track. It is 132 feet west of the easterly extremity of the curved portion of the fence, 190 feet north of the fence on the south side, and 200 feet south of the fence on the north side of the enclosure. True bearings of the following points were determined:—

Bottom of pole on judges' stand, near barns (R. O.), 77° 52′.5 west of north.

West pole on grandstand, 63° 39′.3 west of north.

East pole on grandstand, 54° 10′.6 west of north.

Bottom of pole on pavilion, 46° 38′.8 west of north.

McGregor, Man.—The station is near the northwest corner of a small field belonging to Mr. F. E. Lewin. The field is adjacent to the south side of the school grounds and the street which passes to the west of the school. The point is 26 feet south of the fence on the south side of the school grounds, and 38 feet east of

the street fence. The point is marked by a stake, 2 inches by 4 inches, and projecting 2 inches above ground. True bearings of the following points were determined:—

Tip of pole on C. P. R. water-tank, 16° 25′.2 east of south.

Bottom of spire on Methodist church (R. O.), 43° 37′.6 east of south.

Tip of pole on public school, 62° 6′.9 east of north.

Carberry, Man.—The station is in an open field in the northwestern part of the town, being in block 6, between First and Second avenues, on the north and south, and Dufferin and Lisgar streets on east and west, respectively. It is 88 feet east of Lisgar street, and 172 feet south of First avenue. The point is marked by a 2 by 2-inch stake, driven flush with the ground. True bearings of the following points were determined:—

Top of short pole on front of public school, 89° 13′.9 east of south.

Spire on Presbyterian church, 65° 16′.6 east of south.

Top of pole on bell-tower near town-hall, 52° 4′.8 east of south.

Top of pole on town-hall, 50° 54′.6 east of south.

Spire on English church, 24° 42′.6 east of south.

Top of pole on elevator (R. O.), 12° 42′.2 east of south.

Brandon, Man.—The station is on the Dominion Experimental Farm, being near the summit of the second small ridge lying to the northeast of the farm buildings. It is 231 feet east, and 180 feet north of the southeast corner of the large barn (trees preventing measurements being taken from the northeast corner), 230 feet northwesterly from the Meteorological station, and 24 feet southeast of a flag-pole. A stake, 2 by 4 inches, driven flush with the ground, marks the point. True bearings of the following points were determined:—

West gable of the Superintendent's house, 55° 15′.2 east of south.

Spire on Catholic church in city, 43° 41′.0 east of south.

Top of dome of public school in city, 29° 8′.2 east of south.

Top of central dome of Brandon college, 23° 22′.2 east of south.

Smokestack on mill, 2° 19′.8 east of south.

Griswold, Man.—The station is in an open field, south of the C. P. R. tracks and in line with the west end of the C. P. R. depot. It is 460 feet south of the tracks, and 123 feet south of a well, which is about 6 feet east of a line joining the southwest corner of the C. P. R. depot and station. True bearings of the following points were determined:—

South gable of elevator No. 188, 21° 26′.0 west of north.

West pole of C. P. R. depot, 12° 56′.7 west of north.

East pole of C. P. R. depot, 9° 27′.7 west of north.

East pole on hotel (R. O.), 2° 32′.7 east of north.

South gable of Ogilvie's elevator, 19° 43′.4 east of north.

South gable of International Elevator Company's elevator, 33° 17′.1 east of north.

Virden, Man.—The station is located near the northeast corner of the Agricultural grounds. It is about 70 feet outside the race-track, 57 feet west of the fence on the east side, and 63 feet south of the fence on the north side of the grounds.

The top of the C. P. R. depot may be seen a little to the left of the pole on the Alexandra hotel. The point is marked by a 2 by 2-inch stake which projects 1 inch above ground. True bearings of the following points were determined:—

Bottom of pole on C. P. R. water-tank, 68° 27′.0 west of south.

Bottom of pole on Alexandra hotel (R. O.), 89° 32′.9 west of south.

East gable of Ogilvie's elevator, 83° 2′.4 west of north.

East gable of Impl. Elevator Co's elevator, 69° 29′.7 west of north.

Kirkella, Man.—The station is approximately a relocation of the Carnegie Institution station of 1906. It is southeast of the group of houses comprising the village. It is in line with the west end and 112 feet south of the southwest corner of the main part of the Episcopal church, 109 feet east of the east boundary of the school yard, and 42 feet west of the west side of the street which passes to the rear of the church. A stake, 2 by 2 inches, and 3 inches above ground, marks the point. True bearings of the following points were determined:—

Southeast corner of upper part of elevator No. 27, 37° 54′.5 west of north.

South gable of elevator No. 27 (R. O.), 37° 53′.7 west of north.

Left edge of west chimney on C. P. R. depot, 14° 59′.6 east of north.

Left edge of east chimney on C. P. R. depot, 17° 55′.9 east of north.

Wapella, Sask.—The station is northeast of the town near the northwest corner of the Agricultural grounds. It is 51 feet south of the north fence, and 156 feet east of the west fence. The point is marked by a stake, 4 by 4 inches, and projecting 4 inches above ground. True bearings of the following points were determined:—

North gable of elevator No. 158, 57° 10′.9 west of south.

Top of pole on C. P. R. water-tank 79° 58′.9 west of south.

Bottom of spire on English church, 87° 5′.3 west of north.

Tip of belfry on school (R. O.), 72° 20′.9 west of north.

Broadview, Sask.—The station is a relocation of the Carnegie Institution station of 1906. The point is 54 feet southwest from the southwest corner of the main part of the Grenfell Milling Company's implement house, and 61 feet northwesterly from the southwest corner of the shed at rear of and adjoining the building. True bearings of the following points were determined:—

Southwest corner of stone house on hill (R.O.), 77° 16′.9 west of north.

Southwest corner of west abutment of C. P. R. bridge, 33° 53′.6 west of north.

Spire on Baptist church, 35° 4′.3 east of south.

Wolseley, Sask.—The station is in an open field north of the town, being 40 feet east of a fence which is in line with the west side of the street passing the town-hall. It is west of and in line with the south side of a white cottage, and about 520 feet north of the street passing along the north side of the court-house grounds. True bearings of the following points were determined:—

Tip of spire on German church, 76° 28′.4 east of south.

Bottom of pole on court-house, 9° 33′.8 east of south.

Bottom of pole on town-hall, 3° 32′.2 west of south.

Tip of cross on Catholic church (R.O.), 63° 41′.4 west of south.

Indian Head, Sask.—The station is on the Dominion Experimental Farm, being about 650 feet southeast of the barns. It is on a low-lying field, and about 50 feet northwesterly from a slough. It is 57 feet east of a row of trees on the east side of a lane which passes to the east of the barns, 42 feet northwesterly from the middle of a road running along the north side of the slough, and 190 feet northeasterly from a windmill. A stake, 2 by 2 inches, and 2 inches above ground, marks the point.

The east ventilator of a barn, south of the C. P. R. tracks, bears 4° 56′.6 west of south.

Balgonie, Sask.—The station is in the northeastern part of the town. It is in line with the south side and 119 feet east of the southeast corner of the Methodist church. The point is marked by a stake, 2 inches in diameter and 3 inches above ground. True bearings of the following points were determined:—

Tip of spire on English church (R. O.), 48° 29′.3 west of south.
Bottom of pole on town-hall, 74° 30′.2 west of south.
South gable of elevator No. 77, 63° 33′.6 west of north.
Northwest corner of lower part of elevator No. 11, 1° 49′.9 west of north.

Regina, Sask.—The station is about one-quarter mile southwesterly from the Carnegie Institution station of 1906. It is on the south side of the city, in an open field, which is part of the jail property. It is approximately in the centre of Osler street produced, is 51 feet south of the south side of 16th avenue, and 300 feet east of the east side of Broad street. True bearings of the following points were determined:—

Flag pole in yard south of jail, 44° 49′.2 west of south.
Top of cross on Catholic church, 31° 16′.5 west of north.
Top of cross on Roumanian church, 19° 3′.5 east of north.
Northeast corner of Regina General Hospital, 31° 0′.1 east of north.
Southeast corner of Regina General Hospital, 35° 22′.5 east of north.

Pense, Sask.—The station is in an open field, about 470 feet south of the C. P. R. tracks. It is in line with the east side of the main part of elevator No. 78, and is 450 feet south of the south side of the shed adjoining the elevator. The west chimney of the C. P. R. depot appears slightly to the right of the elevator, and the spire of the English church appears midway between the chimney and north end of 'Hardware' store. True bearings of the following points were determined:—

Southwest corner of Springrice's elevator, 34° 12′.2 west of north.
Spire of English church (R. O.), 21° 55′.0 west of north.
South gable of elevator No. 78, 11° 9′.3 west of north.
South gable of Winnipeg Elevator Co's. elevator, 11° 2′.0 east of north.

Moosejaw, Sask.—The station is in the northern part of the city, being near the southeast corner of the enclosure comprising the Agricultural grounds. The point is 108 feet north of the south fence, 122 feet west of the east fence of grounds, and 73 feet southeast of the fence around the race-course. The point is marked by

a 2 by 4-inch stake, which projects 3 inches above ground. True bearings of the following points were obtained:—

Spire on English church at corner of East High street and 10th avenue, 10° 33'.2 west of south.

Pole on Collegiate Institute (R. O.), 53° 50'.4 west of south.

Spire on dome of house over reservoir, 85° 7'.4 west of south.

Spire on dome west of grandstand, 87° 51'.0 west of north.

Description of Magnetic Stations occupied by J. W. Menzies in 1910.

Napanee.—The station is situated on the circus grounds which border on the third street southwest from the G. T. R. station. The grounds are owned by Sir Richard Cartwright. Transit was placed 162 feet east of the west limit of the street on the west of the grounds and 291 feet north of the north limit of the street bordering the circus grounds on the south. The transit station was also 35.5 feet from the rear lot line of lots facing on the west side of the next street to the east and 55 feet from the intersection of this rear lot line with the street bounding the grounds on the north. The magnetometer was placed 10.3 feet behind the transit and on line with the reference object and the transit. The following true bearings were obtained from the transit station:—

Spire, Western Methodist church, 40° 44'.6 east of south.

Spire, Roman Catholic church, (R.O.), 28° 54'.9 east of south.

Flag pole on High school, 21° 33'.9 west of south.

Belleville.—The station is situated in West Belleville in rear of a lot owned by Mr. Harris, market gardener. The station was 294.5 feet west of the west side of the road allowance in front of Mr. Harris' lot. The Agricultural grounds are in a southerly direction along this road. It is also 51 feet from the south limit of the road allowance on the south of Mr. Harris' lot and 55 feet from a line fence running north from this limit, the road allowance ending at this fence. Mr. Harris' lot does not extend back to this line fence. The following true bearings were obtained from the transit station;—

Spire on church (in Belleville), 80°41'.7 east of north.

Largest spire on tower, which has 3 smaller ones, 82°08'.9 east of south.

Spire, Western Methodist church (R.O.), 75°46'.3 east of south.

A large grove of pine trees is situated in the field south of the station.

Brighton.—The station is situated in a field on the west side of the town, the field belonging to Mr. Nesbitt. This field is in the second block west of Station street, and is the second field north of the C. N. R. tracks. The transit was placed 128.5 feet west of the west side of the first street west of Station street and 118 feet north of the line fence on the south of this field. A large elm tree stands in the northeast corner of this field. The magnetometer was placed 12.3 feet behind the transit and on line with the transit and the reference object. The following true bearings were determined from the transit station:—

Spire of St. Andrews church (R. O.), 42°51'.8 east of north.

Cross on Roman Catholic church, 78° 54'.5 east of north.

Ornament on centre of Nesbitt's barn, 67° 05'.2 west of north.

Peterborough.—The station is on a plot of ground in rear of a lot owned by Mr. Rogers, a veterinary surgeon. Mr. Rogers' lot is on the south side of Charlotte street about one mile west of the G. T. R. tracks. Lot on which station is placed faces on a private lane running south from Charlotte street. The transit was 123 feet west from the west side of this lane and 52 feet north of the line fence bounding this lot on the south. It was also 91 feet and 91.5 feet respectively from the southwest and southeast corners of Mr. Rogers' carriage shed. The magnetometer was placed 11.2 feet behind the transit and on line with the transit and reference object. A large grove of pine trees was just west of the station. The following true bearings were determined from the transit station:—

Pole on stone tower, 65° 34′.7 east of north.

Top of belfry on town-hall (R. O.), 74° 59′.7 east of north.

Top of Rogers' house, 33° 47′.0 west of north.

Newcastle.—The station is situated in a field north of the G. T. R. tracks and in the second block west of the street running under the tracks. The field is owned by Mr. Montague. A creek, dry at times, runs lengthwise of the lot. The transit was placed 144 feet west of the westerly limit of the first street west of the above-mentioned street, and 58.5 feet from the fence on the northerly boundary. It is also 83 feet and 64 feet respectively from the furthest easterly and westerly of five small trees along the north side of the creek. The magnetometer was placed 10.4 feet behind the transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

English church spire, 2° 51′.7 east of north.

Pole on school belfry, 50° 21′.7 east of north.

Spire on Methodist church (R. O.), 5° 20′.6 west of north.

Kinmount.—The station is in a field, belonging to Mr. Craige, which is on the north side of the road in front of Mr. Craige's house and is also about 500 feet east of said house. The station is on the south side of a rocky hill, and transit was placed 266 feet from the easterly side of the only gate on the south side of the road and 239 feet from the intersection of the road fences at the fork of the roads. An abandoned iron mine is on the northerly slope of the hill. The magnetometer was placed 8.5 feet behind the transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Flag pole on grandstand, 41° 42′.2 east of north.

South side of chimney on house at foot of road, 71° 15′.1 east of north.

Cross on Roman Catholic church, 17° 33′.3 west of south.

Pole on public school belfry (R. O.), 55° 54.′7 west of south.

Lindsay.—The station is situated in the same field as the waterworks pump-house, the pump-house being on the southerly limits of the town and on the west bank of the river flowing through the town. The remaining part of the field belongs to the Roman Catholic parish. The transit was placed 154 feet from the south side of the road alongside the pump-house, and 22 feet from the fence on the westerly boundary of said field, and is also 8 feet to the west of the easterly side of street running into the field. The magnetometer was placed 12.4 feet behind transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Middle of iron smoke-stack, 29° 07′.9 east of north.

East corner of pump-house chimney (at top), 60° 30′.7 east of north.

Cross on Roman Catholic church (R. O.), 9° 51′.0 west of north.

Pickering.—The station is situated in the second field north of the G. T. R. tracks, and on west side of the road leading to the grist-mill. This field is used as a pasture, but the southeast corner of the field is fenced off and cultivated. The cemetery is just across the road from the cultivated portion. The transit was placed 128 feet from the westerly side of above-mentioned road and 34 feet from the northerly boundary of cultivated portion, and is also 130 feet in a southerly direction from a large elm tree. The magnetometer was placed 11.4 feet behind transit and in line with transit and reference object. The following true bearings were obtained from the transit station:—

Ornament on town-hall tower, 22° 23′.1 east of north.
Cross on Roman Catholic church (R. O.), 39° 21′.8 east of north.
Flag pole on grist-mill, 13° 30′.7 west of north.

Niagara Falls (*Stamford*).—The station is situated in a large open field belonging to Mr. Emmet, on the south side of the road leading westwards at the fork of the main road at Stamford Green. The station is about one-quarter of a mile westerly along this road and is on a clear patch between a grapery and a raspberry patch. The transit was placed 55 feet from the west side of the berry patch and 116 feet from the east side of the grapery and 63 feet from the southerly side of the road allowance. The Niagara, St. Catharine and Toronto Electric Ry. is distant about $1\frac{1}{2}$ miles in a southerly direction. The magnetometer was placed 11.2 feet behind the transit and on line with the transit and reference object. The following true bearings were determined from the transit station:—

North gable of house on main road, 75° 53′.5 east of south.
Pole on school-house tower (R. O.), 34° 23′.1 east of south.
Windmill on Mr. Emmet's barn, 13° 01′.1 west of south.

Beaverton.—The station is situated in a large open field at the end of the road leading from the G. T. R. tracks on the east side of the G. T. R. station. The field is used as a pasture and is full of small hummocks, the ground being generally of marshy nature. Mr. Trelevan is the owner of the field. The transit was placed 129 feet from the south side of the road running westerly along the southerly boundary of the field, and 28.5 feet from the westerly boundary fence of the field. The above-mentioned boundary road ends at this line fence. The magnetometer was placed 2 feet behind transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Spire on Roman Catholic church, 3° 55′.6 east of south.
Spire on St. Andrews (Presbyterian) church (R. O.), 7° 39′.4 west of south.
Pole on water-tank, 58° 41′.4 west of south.

Port Colborne.—The station is situated in a field on the south side of the G. T. R. tracks. The field is on the east side of the fourth street from the station running in a southerly direction. The station was about 1,000 feet from the tracks. The transit was placed 52 feet from the easterly limit of the street and 37 feet from the northerly limit of the third street south of the tracks. It was also 355 feet from the southerly limit of the second street south of the tracks. An oil well is situated in the next block to the west. The following true bearings were determined:—

Round iron smoke-stack, 28° 51′.8 west of south.
Top of lighthouse tower (R. O.), 43° 00′.0 west of south.
Storm signal post, 88° 42′.3 west of south.

Orillia.—The station is situated in a large marshy field at the end of the first street south of Watson's brickyards, which street runs westerly from the street crossing the G. T. R. tracks west of the station. The clay pits of the brickyard are in this field. The transit was placed 89.5 feet from the westerly boundary of the last lot facing on first street mentioned above, and 104 feet from the intersection of this lot line with southerly street line, and was also 69 feet from the end of the southerly street line fence. A small sand pit is about 150 feet to southwest. The magnetometer was placed 14.2 feet behind the transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Easterly tower on Orillia asylum, 22° 22′.5 west of south.

Southerly tower on town-hall, 55° 58′.3 west of north.

Spire of Anglican church [largest in sight] (R.O.), 39° 18′.5 west of north.

Beamsville.—The station is situated in the second field north from the G. T. R. tracks. The field is not cultivated, but is dotted with scrubby trees and has a grove of trees in the northern part. The field which is on the west side of the road leading to the lake is owned by Rev. Mr. Trueaxe. The transit was placed 26 feet from the westerly boundary fence and 83 feet from the southerly boundary fence of above field. Surrounding fences were of the irregular, rail variety and measurements were taken to the inside fence line. The magnetometer was placed 11 feet behind the transit and on line with the transit and reference object. The following true bearings were determined from the transit station:—

Church spire, visible just over G. T. R. freight-shed (R. O.), 1° 09′.4 west of south.

Factory chimney (middle), 88° 44′.7 west of south.

Barrie.—The station is situated in the northwestern portion of the town, in a field belonging to Mr. Hickey, and just west of the field in which Mr. Hickey's house stands. The transit was placed 86.5 feet from the northerly limit of the street marking the southerly boundary of the field, and 58 feet from the westerly limit of street marking the easterly boundary. The magnetometer was placed 10.8 feet behind the transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Cross on separate school, 52° 19′.0 west of south.

Cross on Roman Catholic church (R. O.), 62° 00′.2 west of south.

North side of water-tower, 76° 36′.5 west of south.

Brampton.—The station is situated in a pasture field at the end of Nelson street. The field is owned by Mr. Ackroyd. The station is on line with the westerly side of Nelson street produced, and is 248 feet from the intersection of this line with the northerly limit of West street. Reference object was spire of Grace Methodist church.

Azimuth of R. O., 22°52′ east of north.

Cayuga.—The station is situated in the third field south of the G. T. R. tracks and on the east side of the road leading to the town. A group of elm trees is situated in the southeast part of the field. The transit was placed 31.5 feet from the northerly boundary fence of said field and 53 feet from the easterly limit of road leading to the town. The field is about 800 feet from the track. The magnetometer was placed 10.3 feet behind the transit and on line with the transit and

reference object. The following true bearings were determined from the transit station.

Pole on water-tank (R. O.), 45° 05′.9 east of north.

Lightning conductor on northwest gable of house across the road, 81° 08′.3 west of north.

Hamilton.—The station is situated in the second field west of the road leading from the Incline railway and fronting on the Chedokee road. A grove of trees lies just over the south boundary of this field. The transit was placed 79 feet from the east boundary fence of said field and 99 feet from the south boundary fence. The magnetometer was placed 11 feet behind the transit and on line with the transit and the reference object. The following true bearings were obtained from transit station:—

Flag pole of tower on a house, 67° 04′.7 east of north.

Top of tower on school-house, 87° 06′.0 east of north.

Flag pole on concert hall on main road (R. O.), 39° 27′.6 west of north.

Penetanguishene.—The station is situated in a field lying on the east side of the fourth parallel street east from the G. T. R. depot. The field lies immediately behind Mr. Gendron's lot, which fronts on the first street from the depot running eastward off Main street. The transit was placed 114 feet north from the southerly boundary and 184 feet from the easterly limit of the above first-mentioned street. It is also 34 feet and 32 feet respectively from two apple trees, one about north and one about northwest from the transit. The following true bearings were determined:—

West end of cross on Catholic church (R. O.), 30° 38′.1 west of south.

Top of small tower on school hill, 35° 04′.1 west of south.

Orangeville.—The station is situated in the third field east from the C. P. R. tracks and fronting on the south side of Chisholm street. Mr. Augustine, who owns the field, lives just east of it. The transit was placed 181 feet from the southerly limit of Chisholm street and 64.5 feet from the westerly boundary of said field. The magnetometer was placed 10.8 feet behind the transit and in line with transit and reference object. The following true bearings were determined from the transit station:—

Top of windmill on hill, 60° 46′.8 east of north.

West side of chimney on cement mills, 35° 29′.3 west of south.

Spire on church in Orangeville (R. O.), 49° 09′.9 west of north.

Guelph.—The station is situated in a pasture field in the northern limits of the town. The field fronts on the east side of Lemon street, and is on the south side of the first road north of and parallel to Stewart street. The magnetometer was placed 222 feet east of the easterly limit of Lemon street and 68 feet south of the southerly limit of above-mentioned road, and is also 508 feet from the northerly limit of Stewart street. The transit was placed 11 feet in front of the magnetometer and on line with magnetometer and reference object. The following true bearings were obtained from the transit station:—

Flag pole on General Hospital (R. O.), 80° 18′.5 west of north.

Eastern gable on Macdonald's barn, 4° 33′.3 west of north.

Brantford.—The station is situated in the rear of a field owned by Mr. Hull, whose house is at the southwest corner of Market street and Grandview avenue. The station was 27 feet at right angles from the south limit of Grandview avenue and 85 feet from the westerly boundary fence. The station is on a hill overlooking the town to the south. The following true bearings were determined:—

Spire of Congregational church (right-hand spire), 1° 34′.7 west of south.

Tower, market-hall, 4° 07′.9 west of south.

Pole on belfry, 11° 41′.0 west of south.

Simcoe.—The station is situated in a field fronting on the south side of the first street, running east and west, north of the grist-mill on Norfolk street. The field contains some sand pits which are on the east side of Norfolk street. The station was 25.8 feet from the boundary fence on the east and 40 feet from the south limit of the above-mentioned street. The station was on the hill above the sand pits. The following true bearings were determined:—

Ornament on grist-mill, 57° 09′.4 west of south.

Ornament on station tower (R. O.), 49° 33′.3 west of north.

Pole on barn just visible over a clump of trees, 14° 49′.4 west of north.

The first street mentioned above ends at easterly boundary fence of the field.

Port Rowan.—The station is situated in the southerly part of the field south of the brick-yards at the G. T. R. tracks. The transit was placed 234 feet from the east side of street bordering this field on the west, and 17 feet north from the north street line produced, of the street which runs westward from the Free Methodist church. The magnetometer was placed 11.3 feet behind transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Tower on Free Methodist church, 48° 01′.9 west of south.

Windmill on barn (R. O.), 48° 49′.8 west of north.

Berlin.—The station is about 1½ miles west of the town on the north side of the St. Petersburg road, and is situated in a field belonging to Mr. J. Shafer. The above field is the first field west of the field in front of Mr. Shafer's house. The transit was placed 126 feet from the northerly limit of the road, and 104 feet from the easterly boundary fence of said field. The magnetometer was placed 13 feet behind transit and on line with reference object and transit. The following true bearings were determined from the transit station:—

North side of large water-tower, 15° 35′.8 east of north.

Church spire in Berlin, 59° 30′.2 east of north.

Bottom of lightning rod on Shafer's barn (R. O.), 64° 11′.2 east of south.

Flesherton.—The station is situated in a field belonging to Mr. Gullinson and is at the northwest corner of the intersection of the first cross-road eastwards from the C. P. R. on the road to Flesherton. The transit was placed 24.5 feet from westerly boundary fence and 117 feet from the southerly boundary fence. The above-mentioned road forms the southerly boundary for about one-half the length of the field. The magnetometer was placed 11 feet behind transit and on line with

reference object and transit. The following true bearings were determined at transit station:—

Belfry pole on school (R. O.), 32° 30′ east of south.

North gable of grain elevator, 18° 48′.3 west of south.

Church spire, Flesherton, 49° 12′.5 east of north.

Woodstock.—The station is situated in a small pasture field belonging to Mr. Hart. This field is on the south side of a short street running easterly from the street bounding Woodstock College grounds on the east, and adjoins Mr. Hart's house and lot at the intersection of the above-mentioned streets. The transit was placed 51.5 feet from the westerly boundary fence and 75 feet from the southerly limit of above-mentioned short street. The magnetometer was placed 13.8 feet behind transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Top of Hydro-electric tower, 10° 13′.0 west of south.

Top of tower Woodstock college [one on which are the wind gauges] (R. O.), 77° 26′.3 west of south.

Smoke-stack on grist-mill, 41° 30′.9 west of north.

Mount Forest.—The station is situated in a small field belonging to Mr. Duke, about one-quarter of a mile west of the G. T. R. tracks on the main road. A short road runs into the main road from the north at this point at an angle, making the field triangular in shape. This field adjoins the field on which Mr. Duke's house is placed. The transit was placed 178 feet from the easterly boundary fence and 65 feet at right angles from the easterly limit of the short road. A large maple tree stands on the northerly part of the field. The magnetometer was placed 11.4 feet behind transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Spire of Methodist church [left hand spire] (R. O.), 75° 01′.1 east of north.

Church spire, Mount Forest, 82° 42′.4 east of north.

Top of station tower, 87° 21′.1 east of north.

Port Burwell.—The station is situated in a field on the north side of Pitt street and adjoining the English church on the east side. A creek runs across the easterly part of the field. The station was 49 feet from the westerly boundary fence and 135 feet from the northerly limit of Pitt street. The following true bearings were determined:—

Southeast corner of Baptist church tower, 54° 23′.2 east of north.

Tower, English church, 73° 48′.3 west of south.

Belfry on school-house (R.O.), 10° 31′.4 west of north.

Owen Sound.—The station is situated in the Agricultural grounds on top of hill in the easterly section of the town. The transit was placed 202.5 feet from the northeast corner of north wing and 235 feet from the southeast corner of south wing of the main building; also 97.2 feet from northwest corner of the grandstand. Magnetometer was placed 13.3 feet behind transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Spire on Roman Catholic church (R. O.), 12° 21′.0 east of north.

Flag pole on Strathcona school, 81° 19′.3 west of north.

Stratford.—The station is situated in Queens park, near the Avon river. The station was 230 feet east of the east side of the Normal school and 580 feet north of the north side of the school. It was also 198 feet from the westerly tree of a clump of three trees on the river bank and 171 feet from the easterly tree. The following true bearings were determined:—

Flag pole on Normal school, 23° 02′.4 west of south.

Spire, Knox Presbyterian church (R. O.), 67° 05′.4 west of south.

Top of house with peculiar mushroom top, 64° 23′.1 west of north.

Port Stanley.—The station is situated in a small pasture field belonging to Mr. Mitchell, on the road leading westerly from the town and about one-half mile distant. This field is between Fraser Heights and the road, and is the second field west of the second road leading up to Fraser Heights. There is a line of apple trees along the boundary fence at the road. The transit was placed 121.5 feet from the westerly boundary fence and 103.3 feet from the southerly limit of the road. The magnetometer was placed 8.4 feet behind the transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Small church spire, pyramid in form (R. O.), 55° 52′.7 east of north.

Flag pole on hotel on Fraser Heights, 47° 18′.3 east of south.

South gable of red brick house, 5° 26′.4 west of north.

London—The station is situated in a field belonging to Mr. D. Barclay and is on the north side of the road leading westerly from the G. T. R. station. This field adjoins, on the east side, the field in which Mr. T. Lewis' house is situated. The magnetometer was placed 49 feet from the westerly boundary fence and 26 feet from the northerly limit of the road. The following true bearings were determined from the transit station which was 81 feet in a northeasterly direction from the magnetometer station:—

Middle of three lightning roads on red barn north of tracks (R. O.), 24° 43′.4 east of north.

South gable of barn, 46° 30′.4 east of north.

Wingham—The station is situated in a small field at the northeast corner of the intersection of St. Patrick street and Carling avenue. The transit was placed 78 feet from the northerly limit of St. Patrick street, and 62.5 feet from the easterly limit of Carling avenue. The magnetometer was placed 15 feet behind the transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Top of G. T. R. semaphore, 45° 41′.3 east of north.

East side of water-tower, 24° 04′.8 west of south.

Lightning rod on south end of red barn north of tracks (R. O.), 11° 17′.2 west of north.

Lucan.—The station is situated in a field west of the G. T. R. station and south of the tracks. The field, which belongs to Mr. J. Babb, adjoins on the west side the field in which Mr. Babb's house is placed. The transit was placed 43 feet north of the southerly boundary fence and 363 feet west of the easterly boundary fence. The magnetometer was placed 10 feet behind the transit and on line with transit and

reference object. The following true bearings were determined from the transit station:—

North side chimney on grist-mill, 51° 53′.1 east of north.

Windmill, 67°10′.4 east of north.

Tower on High school (R. O.), 3° 39′.1 west of north.

Kincardine.—The station is situated in a field across the road from the High school in a southerly direction and bordering the Penetangore on the west side. The field is owned by Miss McCaskey. The transit was placed 170.5 feet from the southerly limit of the road and 38 feet from the easterly boundary fence. The magnetometer was placed 13 feet behind the transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Ornament on western gable of Methodist church (R. O.), 73° 24′.1 west of south.

Flag pole on post-office, 89° 54′.6 west of south.

Spire, Presbyterian church, 47° 46′.9 west of north.

Rodney.—The station is situated in a small pasture field on the south side of Harper street. This field is owned by Mr. Hugo and is the second field west of the first street intersection on Harper street west of Furnivale street. Mr. Hugo's house is on the southeast corner of this intersection. The station was 131 feet from the westerly boundary fence, and 56 feet from the southerly limit of Harper street. The following true bearings were determined:—

Smoke-stack on planing mill, 2° 59′.7 east of north.

Spire on Presbyterian church (R. O.), 43° 23′.6 east of north.

Smoke-stack on box factory, 75° 13′.1 east of south.

Goderich.—The station is situated on the commons bordering on the G. T. R. tracks and opposite to McEwan's wood-yard. The station was 524 feet from the northerly limit of the street and 209 feet from the fence bordering the commons on the east. This last measurement was taken on a line parallel to the road. The following true bearings were determined:—

Top of station tower (R. O.), 14°43′.9 east of south.

Church spire, Goderich, 77° 01′.1 west of south.

Forest.—The station is situated in the Agricultural grounds on Argyle street. The station was 87 feet from the southerly boundary fence of grounds and 107 feet from the westerly boundary fence. The following true bearings were determined:—

Spire, Roman Catholic church 69°15′.2 east of north.

Spire, Presbyterian church (R. O.), 88°48′.9 east of north.

Tower on High school, 46° 04′.2 east of south.

Chatham.—The station is situated in a field fronting on the north side of the first road south of Queen street, and running parallel with it. The field is opposite the Agricultural grounds on Queen street and is owned by Mr. Hoff. The transit was placed 46.8 feet from the easterly boundary fence and 137.3 feet from the northerly limit of the above-mentioned road. The magnetometer was placed 10.8 feet

behind the transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Flag pole on main building of Agricultural grounds (R. O.), 30°55′.6 east of north.

Church spire (only one to be seen), 13°05′.4 west of north.

Top of G. T. R. water-tank, 32°11′.4 west of north.

Sarnia.—The station is in a field on the east side of Telford street and south of Russell street. The field adjoins, on the north side, a lot containing a house and orchard. The field is owned by Mr. Shannon and is south of his house which fronts on Wellington street. The transit was placed 57 feet from the southerly boundary fence and 190.5 feet from the easterly limit of Telford street. The magnetometer was 10.5 feet behind the transit and on line with transit and reference object. The following bearings were observed from the transit station:—

School tower (Russell street), 24°49′.2 west of south.

Flag pole on post-office, 77°50′.8 west of north.

Spire, St. Andrews church (R. O.), 54°28′.2 west of north.

Port Lambton.—The station is situated in rear of a large cultivated field east of the Pere Marquette railway. This field belongs to Mr. McDonald and adjoins, on the north side, his large pasture field. The field is also about 1,000 feet north of the road leading east from the railway station. The transit was placed 87.5 feet from the easterly boundary fence and 72.5 feet from the southerly boundary fence. The magnetometer was 10 feet behind the transit and in line with transit and reference object. The following true bearings were determined from the transit station:—

South end of the only barn to be seen in this direction, 35°47′.0 east of north.

North end of red barn, 48°11′.3 west of south.

Flag pole on the 'Ohio' cottage (R. O.), 48°08′.9 west of north.

Belle River.—The station is situated in a field about one-quarter mile east of the town and on the north side of Main street produced. The field is owned by Mr. Dube and adjoins, on the east side, a field containing a house and a large vegetable patch. The transit was placed 238 feet from the easterly boundary fence and 246 feet from the northerly limit of road. The magnetometer was 11.3 feet behind the transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Spire, Roman Catholic church (R. O.), 75°49′.1 west of south.

Tower on school-house, 85°10′.5 west of south.

Smoke-stack on cannery, 76°10′.5 west of north.

Kingsville.—The station is situated in a field on the west side of a private lane which turns off the Main street, produced, at Mr. C. McDonald's house. This field is the second field from the main road and belongs to Mr. C. McDonald. The transit was placed 204.6 feet from the northerly boundary fence and 149 feet from the westerly limit of private lane. The magnetometer was 9.3 feet behind the transit and on line with transit and reference object. The following true bearings were determined from the transit station:—

Spire, Roman Catholic church (R. O.), 71°35′.5 east of south.

North end of McDonald's barn, 23°06′.1 east of south.

N.W. gable of barn, 75°16′.9 west of south.

Windsor.—The station is situated in a large pasture field on the north side of the Teeumseh road and about 700 feet east of the intersection of the C. P. R. branch to the Walkerville Bridge and Iron works and the Teeumseh road. The field, which is owned by Mr. Stanley, is full of stumps and many small bushes are seattered about. The transit was plaeed 186 feet from the westerly boundary fence and 244 feet from the northerly limit of the Tecumseh road. The magnetometer was placed 9.3 feet behind the transit and on line with transit and reference objeet. The following true bearings were determined from the transit station:—

East gable of red barn, 13°01′.3 west of south.

Spire, St. Alphonse ehureh (R. O.), 57°34′.8 west of north.

Spire on tower elose to large building in Detroit, 26°26′.1 west of north.

MAGNETIC RESULTS FOR 1910—ONTARIO.

OBSERVER, J. W. MENZIES.

Station	φ		λ		Date	Decl.		Dip.		Hor. Int.	Total Int.
	°	′	°	′	1910	°	′	°	′		
Napanee	44	15·9	77	00·0	Nov. 9, 11	10	36·8W	74	25·2	·16369	·60946
Belleville	44	9·2	77	25·5	" 12–16	8	55·0W	74	55·0	·15760	·60563
Brighton	44	2·0	77	44·0	" 19	8	42·0W	74	48·6	·15957	·60900
Peterborough	44	18·6	78	18·5	" 5, 7	8	45·5W	74	42·6	·16327	·61914
Newcastle	43	54·3	78	31·8	" 22	7	47·5W	74	43·3	·16083	·61034
Kinmount	44	47·1	78	38·0	" 3, 4	8	40·6W	75	16·9	·15488	·60960
Lindsay	44	21·0	78	44·0	Oct. 26–29	7	35·6W	75	09·9	·15726	·61421
Pickering	43	51·3	79	4·3	Nov. 2	7	07·9W	74	44·1	·16124	·61242
Niagara Falls	43	07·7	79	6·3	Sept. 20, 21	6	00·3W	74	12·0	·16490	·60562
Beaverton	44	26·0	79	07·0	Oct. 25	7	31·8W	75	3·2	·15802	·61267
Port Colborne	42	53·2	79	14·3	Sept. 17	5	47·5W	73	58·1	·16754	·60666
Orillia	44	35·8	79	25·3	Oct. 22, 24	5	38·6W	75	29·7	·15389	·61442
Beamsville	43	11·5	79	28·5	Sept. 22	5	51·3W	74	31·4	·16481	·61762
Barrie	44	23·7	79	42·5	Oct. 18, 19	6	46·1W	75	20·1	·15535	·61363
Brampton	43	40·9	79	45·5	Aug. 1, 2	5	56·5W	74	34·7	·16293	·61270
Cayuga	42	58·0	79	51·0	Sept. 16	6	34·7W	73	50·3	·17044	·61233
Hamilton	43	14·4	79	54·0	" 23–27	5	32·4W	74	19·2	·16534	·61177
Penetanguishene	44	46·4	79	58·0	Oct. 20, 21	7	29·6W	75	32·4	·15318	·61345
Orangeville	43	54·7	80	05·0	" 17	6	01·8W	74	42·9	·16190	·61414
Guelph	43	33·0	80	15·0	Aug. 4	5	50·0W	74	28·2	·16438	·61395
Brantford	43	08·7	80	15·5	Sept. 29	4	43·8W	74	13·8	·16623	·61164
Simcoe	42	51·0	80	19·5	" 5, 6	4	54·2W	74	05·8	·16805	·61329
Berlin	43	26·9	80	30·0	" 15	5	34·0W	74	27·7	·16467	·61471
Port Rowan	42	38·0	80	27·5	Aug. 6, 8	4	39·6W	73	49·3	·17033	·61132
Flesherton	44	14·9	80	33·5	Oct. 15	5	26·2W	74	56·6	·15592	·60021
Woodstock	43	07·5	80	43·5	Sept. 30, Oct. 1	3	53·6W	74	07·8	·16730	·61180
Mount Forest	43	59·2	80	45·0	Oct. 11, 12	5	07·0W	74	46·4	·16086	·61248
Port Burwell	42	38·9	80	49·0	Sept. 2	4	15·1W	73	45·9	·17014	·60856
Owen Sound	44	33·3	80	55·0	Oct. 13, 14	6	01·5W	75	13·4	·15703	·61568
Stratford	43	21·8	80	58·5	Aug. 10, 11	3	48·5W	74	24·8	·16545	·61575
Port Stanley	42	39·9	81	13·5	" 30, 31	2	40·7W	74	05·4	·16705	·60939
London (Hyde Park Jct.)	42	59·3	81	19·0	Oct. 3	3	34·0W	73	59·8	·16795	·60919
Wingham	43	54·1	81	20·8	" 8	4	30·4W	74	39·7	·16241	·61398
Luean	43	10·7	81	24·8	Aug. 12	3	55·9W	74	03·1	·16832	·61258
Kineardine	44	10·3	81	37·5	Oct. 10	5	25·6W	74	38·0	·16333	·61635
Rodney	42	34·0	81	41·0	Aug. 29	3	29·9W	73	47·3	·17138	·61373
Goderieh	43	45·7	81	42·5	Oct. 5, 7	4	32·3W	74	31·6	·16379	·61393
Forest	43	05·6	82	00·8	Aug. 13	3	41·3W	73	57·8	·16907	·61201
Chatham	42	23·1	82	10·0	" 19, 20	2	25·9W	73	37·5	·17252	·61194
Sarnia	42	57·7	82	22·5	" 16	3	01·3W	73	50·5	·17045	·61248
Port Lambton	42	39·0	82	30·0	" 17, 18	2	48·7W	73	33·0	·17333	·61209
Belle River	42	17·4	82	41·8	" 22, 23	1	49·8W	73	21·7	·17443	·60919
Kingsville	42	02·2	82	45·8	" 26, 27	1	32·1W	73	06·9	·17664	·60816
Windsor	42	17·9	83	15·0	" 24, 25	1	59·0W	73	14·6	·17547	·60862

MAGNETIC RESULTS FOR 1910—ALONG MAIN LINE, CANADIAN PACIFIC RAILWAY

OBSERVER, C. A. FRENCH.

Station.	φ	λ	Date.	Decl.	Dip.	Hor. Int.	Total Int.	Diurnal Range in Dec.
	° ′	° ′	1910.	° ′	° ′			′
Ottawa	45 23·6	75 43·0	Apr. 1 to 20	13 2·2W	75 39·8	·15114	·61037	9·2
Agincourt	43 47·0	79 16·0	May	6 3·1W	74 38·3	·16275	·61436	9·2
Chapleau	47 50·3	83 25·6	" 7, 9	4 16·4W	77 51·7	·13219	·62866	14·8
Wayland	48 2·4	83 49·9	" 10, 11	5 8·8W	77 58·0	·13067	·62677	12·2
Missinaibi	48 18·8	84 5·2	" 14, 16	5 48·8W	77 49·9	·13272	·62965	13·6
Grasett	48 27·3	84 37·6	" 19, 20	3 46·1W	78 9·6	·12878	·62765	12·6
White River	48 35·2	85 16·3	" 23, 25	3 11·9W	78 19·4	·12768	·63087	15·5
Montizambert	48 41·3	85 38·6	" 27, 28	2 22·3W	78 25·3	·12698	·63266	12·6
Heron Bay	48 39·3	86 17·3	" 30, 31	2 33·4W	78 3·9	·13087	·63283	13·6
Middleton	48 47·7	86 40·3	June 4	17 48·9E	80 22·0	·10418	·62256	19·6
Schreiber	48 48·5	87 16·6	" 7	0 31·7W	78 26·2	·12626	·62988	12.9
Gravel	48 54·7	87 43·6	" 10	0 25·1E	78 35·0	·12453	·62912	11·5
Nipigon	49 0·7	88 15·9	" 11, 13	1 7·0E	78 29·6	·12653	·63429	14·2
Dorion	48 46·8	88 32·0	" 14	1 39·3E	78 17·3	·12826	·63186	11·3
Mackenzie	48 33·0	88 58·5	" 15	2 49·3E	78 13·6	·13021	·63816	11·3
Fort William	48 23·9	89 14·9	" 17, 18	3 16·5E	77 49·4	·13322	·63159	12·2
Kaministikwia	48 31·5	89 35·1	" 22	0 25·3E	80 3·5	·10746	·62243	15·8
Raith	48 49·8	89 53·6	" 23-25	3 49·8E	78 11·0	·12954	·63258	12·5
Savanne	48 57·0	90 14·0	" 27, 28	4 28·1E	78 12·2	·12951	·63349	15·2
Niblock	49 16·3	90 41·3	" 30, July 1	4 54·5E	78 10·8	·13018	·63553	15·0
Martin	49 15·3	91 7·9	July 2, 4	4 58·1E	78 9·3	·13089	·63766	14·0
Ignace	49 25·4	91 40·5	" 6-8	6 10·5E	78 30·1	·12678	·63600	14·6
Taché	49 35·0	92 10·7	" 11, 12	6 57·4E	78 22·9	·12772	·63419	14·1
Wabigoon	49 43·6	92 36·8	" 13, 14	7 39·0E	77 49·6	·13364	·63376	15·5
Dryden	49 47·4	92 50·1	" 16, 17	8 14·1E	79 22·6	·11565	·62733	20·6
Eagle	49 47·7	93 11·1	" 18-20	6 34·7E	78 10·4	·13050	·63674	17·2
Vermilion	49 51·3	93 23·5	" 22	7 42·8E	78 59·9	·12180	·63824	17·1
Hawk Lake	49 58·3	93 59·7	" 23, 24	7 28·4E	78 26·8	·12806	·63941	17·7
Kenora	49 46·2	94 29·0	" 26, 27	10 0·4E	77 59·4	·13122	·63062	14·8
Kalmar	49 45·7	94 58·0	" 28, 29	9 31·7E	77 52·7	·13345	·63551	12·5
Rennie	49 51·5	95 33·3	" 29-31	10 19·7E	77 27·7	·13779	·63471	12·6
Whitemouth	49 57·0	95 57·8	Aug. 1, 2	10 57·0E	78 10·3	·13083	·63826	18·2
Norquay	49 59·6	96 33·9	" 4, 5	11 23·0E	78 41·5	·12549	·63996	18·2
Winnipeg	49 51·9	97 7·9	" 8, 9	13 56·7E	78 11·3	·13061	·63807	13·8
Marquette	50 4·1	97 43·0	" 11, 12	13 17·7E	78 5·9	·13039	·63225	15·2
Portage-la-Prairie	49 58·5	98 17·9	" 15, 16	9 26·9E	78 29·0	·12810	·64161	15·9
McGregor	49 58·4	98 47·4	" 17, 18	13 9·6E	77 40·4	·13502	·63246	17·4
Carberry	49 52·5	99 21·6	" 19, 20	15 44·0E	77 39·1	·13529	·63263	15·6
Brandon	49 52·0	99 58·8	" 23-25	15 3·9E	77 32·2	·13687	·63420	16·8
Griswold	49 46·9	100 28·7	" 26	16 4·6E	77 15·9	·14005	·63531	13·5
Virden	49 51·3	100 55·7	" 27, 28	16 43·1E	77 10·1	·13976	·62930	13·0
Kirkella	50 1·9	101 22·4	" 30, 31	16 13·9E	77 17·5	·13931	·63326	11·2
Wapella	50 15·8	101 58·4	Sept. 1, 2	17 50·6E	77 22·9	·13803	·63185	15·2
Broadview	50 22·3	102 34·7	" 3, 5	17 13·3E	77 38·9	·13515	·63180	13·8
Wolseley	50 26·3	103 15·5	" 9, 10	18 18·1E	77 20·7	·13850	·63219	17·8
Indian Head	50 32·2	103 39·5	" 12, 13	19 32·7E	77 3·6	·14147	·63176	13·4
Balgonie	50 29·6	104 16·1	" 14, 15	18 57·6E	77 3·8	·14071	·62852	12·7
Regina	50 26·9	104 36·8	" 16, 17	19 26·8E	76 58·3	·14210	·63034	12·4
Pense	50 24·7	104 59·1	" 19	19 45·5E	76 53·6	·14222	·62717	14·0
Moosejaw	50 23·9	105 30·9	" 20-23	19 52·9E	77 0·6	·14096	·62709	11·3
*Agincourt	43 47·0	79 16·0	Oct.	6 5·4W	74 39·4	·16244	·61391	9·2
Ottawa	45 23·6	75 43·0	" 20-26	13 3·2W	75 41·1	·15096	·61053	11·2

* The values for Agincourt represent the means of the month, and were obtained from the Journal of the Royal Astronomical Society of Canada for May-June, and for November-December, 1910.

Secular Change.

We have now for a few stations in our survey, data wherefrom we can deduce secular change in declination, by comparison of the magnetic results obtained by the Carnegie Institution in 1906 and by the Dominion Observatory in 1910 at corresponding stations, as shown in the following table. From them is deduced the average annual change for the mean period of the respective observations.

Westerly declination is negative, easterly declination positive. In the column "Average Annual Change" for declination, a minus sign indicates that western declination is increasing, and eastern declination decreasing, while the plus sign means the reverse.

Station.	Declination.					Dip.			Horizontal Intensity.		
	Carnegie Institution, 1906		Dom. Observatory, 1910		Average Annual Change	Carnegie Ins. 1906	Dom. Obs. 1910	Average Annual Change.	Carnegie Ins. 1906	Dom. Obs. 1910	Average Annual Change
		° ′		° ′	′	° ′	° ′	′	C. G. S.	C. G. S.	γ
Ottawa.......	Oct.	−12 44·4	Oct.	−13 03·2	− 4·7	75 39·1	75 41·1	0·5	·15222	·15096	31
Chapleau.....	"	− 4 04·4	May	− 4 16·4	− 3·5	77 50·6	77 51·7	0·3	·13292	·13219	20
Missinaibi....	Sep.	− 5 39·1	"	− 5 48·8	− 2·7	77 51·6	77 49·9	−0·5	·13303	·13272	8
White River..	"	− 3 00·6	"	− 3 11·9	− 3·1	78 15·9	78 19·4	0·9	·12909	·12768	38
Schreiber.....	"	− 0 22·4	June	− 0 31·7	− 2·5	78 24·8	78 26·2	0·4	·12707	·12626	22
Nipigon*......	"	1 17·5	"	1 07·0	− 2·8	78 28·6	78 29·6	0·3	·12742	·12653	24
Fort William†.	"	3 37·2	"	3 16·5	− 5·5	77 48·0	77 49·4	0·4	·13414	·13322	25
Savanno......	"	4 33·8	"	4 28·1	− 1·5	78 09·9	78 12·2	0·6	·13038	·12951	23
Ignace........	"	6 14·6	July	6 10·5	− 1·1	78 27·4	78 30·1	0·7	·12791	·12678	29
Eagle.........	"	6 39·7	"	6 34·7	− 1·3	78 07·8	78 10·4	0·7	·13135	·13050	22
Kenora.......	"	9 54·1	"	10 00·4	+ 1·6	77 58·9	77 59·4	0·1	·13176	·13122	14
Winnipeg.....	"	13 59·0	Aug.	13 56·7	− 0·6	78 07·4	78 11·3	1·0	·13163	·13061	26
Brandon†.....	"	15 00·2	"	15 03·9	+ 0·9	77 28·7	77 32·2	0·9	·13807	·13687	31
Kirkella......	"	16 02·4	"	16 13·9	+ 2·9	77 17·7	77 17·5	0·1	·13996	·13931	17
Broadview....	"	17 05·7	Sept.	17 13·3	+ 1·9	77 37·5	77 38·9	0·3	·13588	·13515	18
Regina†.......	"	19 12·0	"	19 26·8	+ 3·7	76 56·8	76 58·3	0·4	·14285	·14210	19

* C. I. Station about 15 feet from D. O. Station.
† C. I. Station and D. O. stations not identical.

Gravity

During the past season no member of the staff was available for making gravity observations.

I have the honour to be, sir,

Your obedient servant,

OTTO KLOTZ.

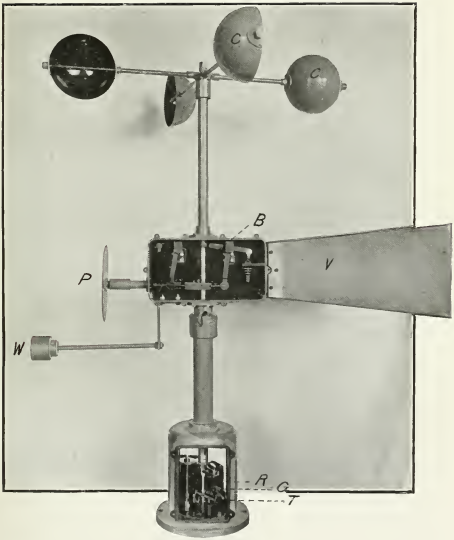


FIGURE 1.

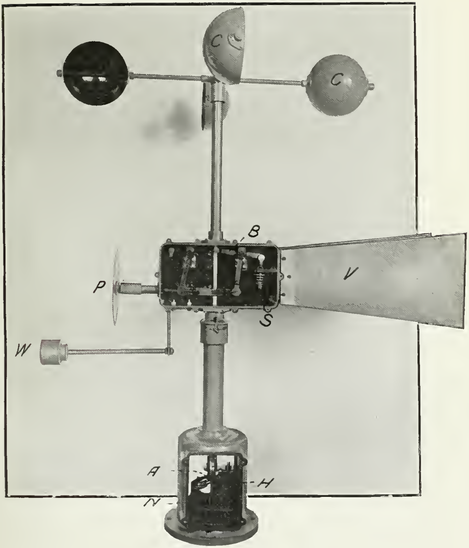


FIGURE 2

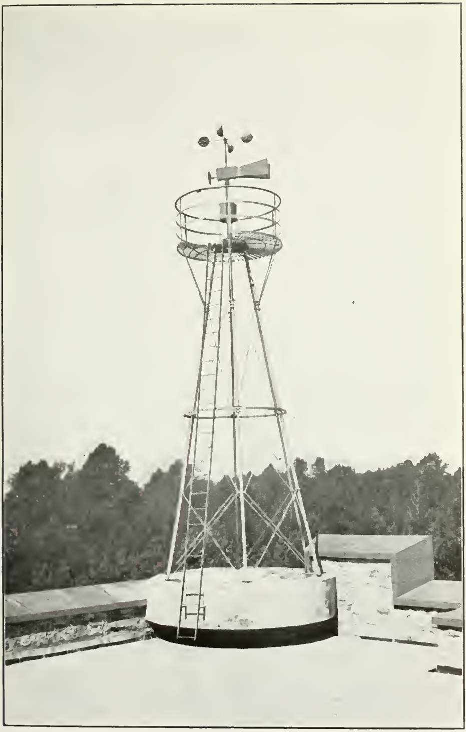


Figure 3.

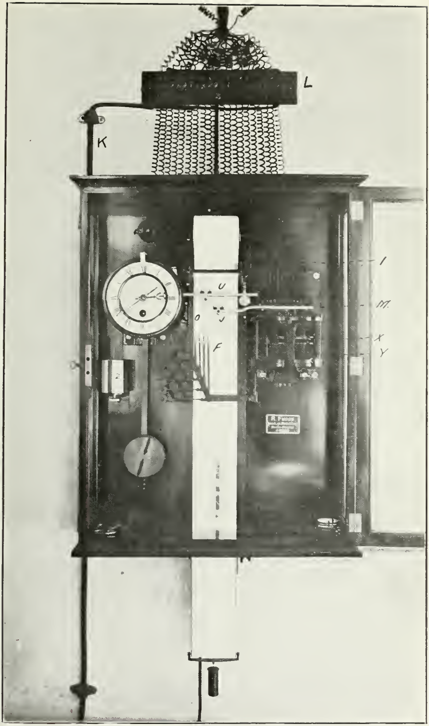


FIGURE 4.

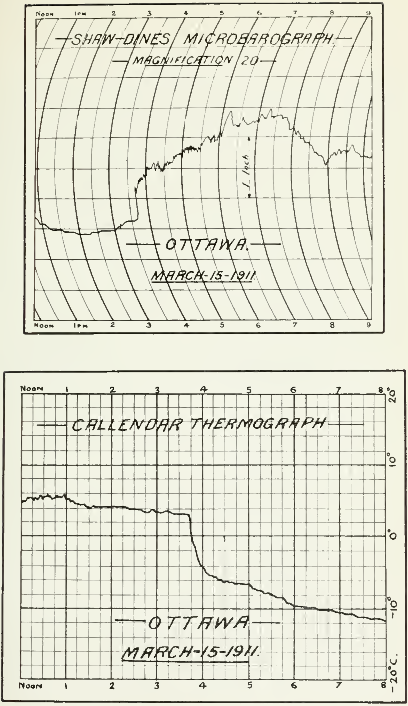

SHAW-DINES MICROBAROGRAPH
MAGNIFICATION 20
OTTAWA.
MARCH-15-1911.
1 Inch
Noon 1PM 2 3 4 5 6 7 8 9
CALLENDAR THERMOGRAPH
OTTAWA
MARCH-15-1911.
Noon 1 2 3 4 5 6 7 8
20° 10° 0° −10° −20°C.

Figure 5.

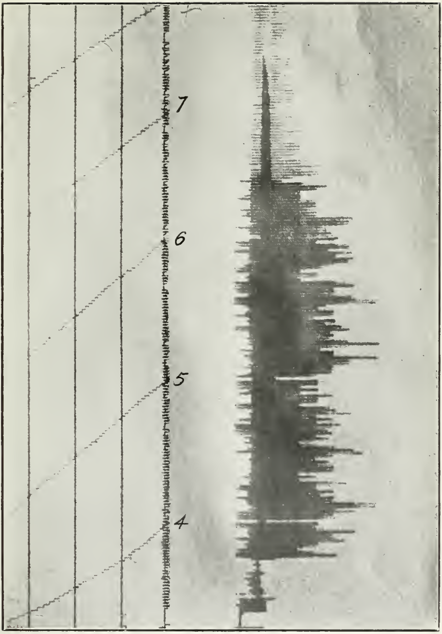


Fig. 6.—Anemogram March 15, 1911.

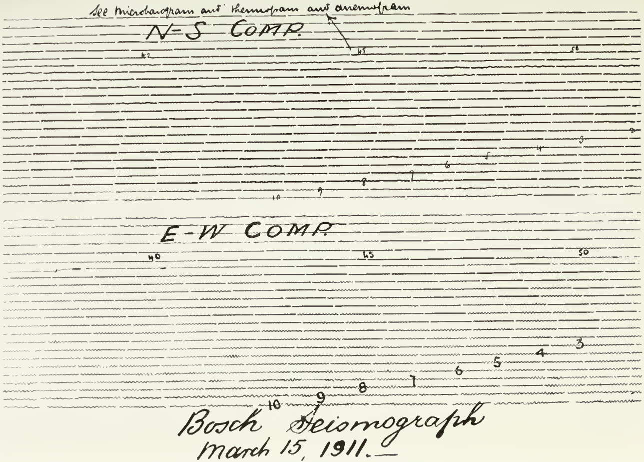
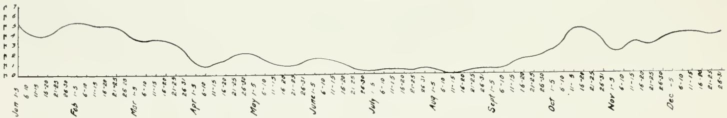

See microbarogram and thermogram and anemogram
N-S COMP.
E-W COMP.
Bosch Seismograph
March 15, 1911.

FIGURE 7.

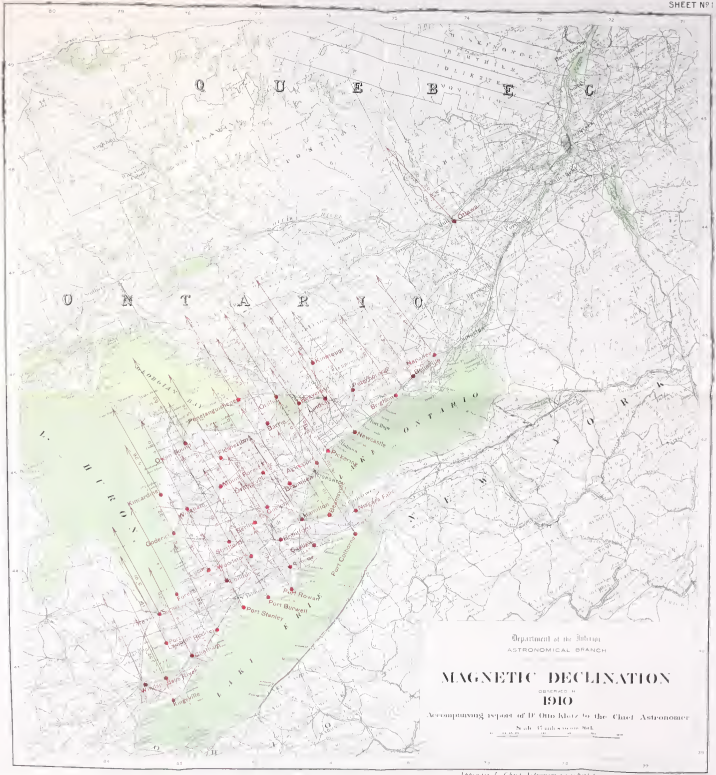


MICROSEISMS. SEASONAL CHANGE 1910.

FIGURE 8.

1913

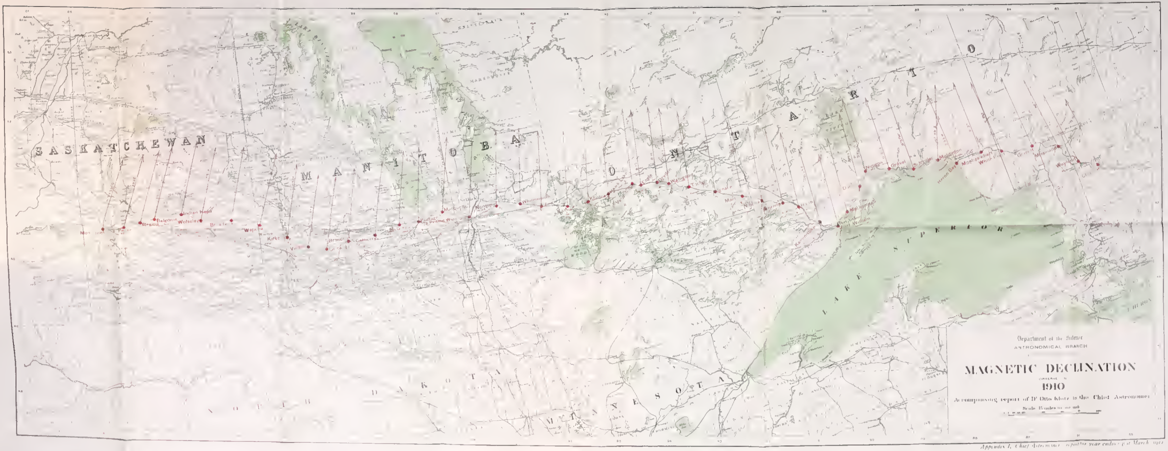
SHEET No. 1



Appendix I, Chief Astronomer's report for year ending 31st March, 1911

1913

SHEET No 2



Appendix I, Chief Astronomer's report for year ending 31st March 1911

APPENDIX 2.

REPORT OF THE CHIEF ASTRONOMER, 1911.

ASTROPHYSICAL WORK

BY

J. S. PLASKETT, B.A.

CONTENTS.

Appendix D.—Solar Physics.—Ralph E. De Lury, M.A., Ph.D. (continued). PAGE

Appendix E.—R. M. Motherwell, M.A.

ILLUSTRATIONS

APPENDIX 2.

ASTROPHYSICAL WORK BY J. S. PLASKETT, B.A.

OTTAWA, CANADA, April 1, 1911.

W. F. KING, ESQ., C.M.G., LL.D.,
Chief Astronomer,
Ottawa.

SIR.—I have the honour to submit the following report upon the work carried on in the Astrophysical Division and in other departments of the work of the Observatory during the past year.

This report contains a summary of the whole work of the division followed by detailed accounts, generally in the form of appendices, of the various pieces of work carried on by the observers under my charge. Each of these appendices, as in former years, is written by the observer responsible for the work and appears over his signature, and in this regard I can only repeat the commendation given in previous reports of the zeal and efficiency of my assistants, to which is due in a large measure the amount and quality of the work.

For convenience of treatment the work will be classified under the following headings:—

1. *Stellar Spectroscopy.*—The main work under this heading is the determination of the radial velocities of selected stars. These consist almost wholly of spectroscopic binaries whose velocity curves and orbits are being investigated, but a few star spectra for other purposes have been obtained.

2. *Solar Research.*—This subdivision includes the work on the solar rotation and allied investigations with the coelostat telescope and grating spectrograph, daily solar photographs with the equatorial telescope, and miscellaneous work along similar lines.

3. *Micrometric and Photographic Work.*—This includes the measurement of the position angle and distance of double stars, the observation of the occultation of stars by the moon, and comet and stellar photography.

4. *Mechanical Work.*—The work of the mechanicians and carpenter in the construction of new and the repair and alteration of existing instruments is also included as being under my charge.

5. In addition to the above, directly in connection with and purely the work of the Observatory, it seems desirable to add a subdivision for the work being done by myself as representing the Observatory on several international committees dealing with important astrophysical questions. These committees were organized last

year, and I was appointed thereon at the meetings of the 'Astronomical and Astrophysical Society of America' at Cambridge, Mass., and of the 'International Union for Co-operation in Solar Research' at Mount Wilson, Cal., which I had the honour of attending as the representative of this Observatory. A report of these meetings and of the work of the committees will be given later.

The division of the work has followed practically the same lines as last year. Messrs. Harper, Cannon and Parker devoting their whole time to radial velocity work, Dr. DeLury to solar and allied chemical research, and Mr. Motherwell to the micrometric and photographic work, and to the supervision of the surveying and astronomical instruments. My own time has been occupied principally with stellar spectroscopy and work on the solar rotation. The radial velocity work having become well systematized and arranged, has left me free to devote more time to other branches of the work, and consequently considerable of my energy has been devoted to working with Dr. DeLury in the difficult problem of the Spectroscopic Determination of the Solar Rotation.

Stellar Spectroscopy.

As in previous years, satisfactory progress has been made in the determination of stellar radial velocities, especially of spectroscopic binaries. Part of my own time and the whole time of Messrs. Harper, Cannon and Parker is devoted to this work. The observing is divided between the four above mentioned, about nine half nights per week being allotted for work with the spectrograph. A regular programme of observation is followed, no attempt being made to have any observer secure the spectra of any particular stars. After the spectra are obtained, however, a division is made, each one undertaking the measurement and reduction of all the plates of one or more binaries and the computation of the orbits, this arrangement tending to more uniform treatment of the binaries and also making the work much more interesting. Following this scheme, as in former years, each observer discusses the work he has done and this appears as an appendix to this report.

A change has been made this year in the method of publishing the measures of the spectra. For the last two years all the measures have been published in an appendix by themselves, so that in the discussion of the orbit only the summary of the plate velocities appeared. This was for the purpose of preventing the breaking up of the continuity of the text by the introduction of many pages of measures, but had the disadvantage that each orbit was in a sense incomplete as the individual measures were not included. Furthermore, owing to the large number of measures of the year before last, this part of the report occupied a very disproportionate amount of the space, and it was felt desirable to abbreviate it if possible. Various schemes were considered, and the one appearing in the present report was finally adopted as containing all the necessary information in less than a quarter of the space. This saving was effected, in the first place, by omitting the micrometer settings and corrections for the star and comparison lines, and, in the second place, by grouping a number of plates together so that the annual diurnal and curvature corrections occupy relatively much less space. The velocities for each star line measured with their weights, the weighted mean and the final radial velocity of the plate are given in a tabular and compact form. This change would have been applied last year but for the fact that the long delay in the publication of the reports prevented us from realizing how much space the measures actually occupied. It is believed that in this new method there will not be more than three or four pages of measures for an average spectroscopic binary.

In obtaining the spectra discussed herein, five different adaptations of two spectrographs have been used, designated as I L, III L, III S, III R and I. The following table gives some of the constants of the instruments:—

SPECTOGRAPHS.

Designation.	Spectrograph.	No. of Prisms.	Focus of Coll.	Focus of Camera.	Å per mm. at H_γ.
I L	Ottawa Spectrograph...	1	525 mm.	525 mm.	30.2
III L	" " ..	3	525 "	525 "	10·1
III S	" " ..	3	525 "	300 "	17·5
III R	" " ..	3	525 "	260 "	20·2
I	New Single-Pr. Spect...	1	765 "	455 "	33·4

The Ottawa spectrograph referred to above was described in my report of 1906–7, p. 73, while the new single-prism spectrograph was described in my report of 1908–9, p. 163. The differences in III L, III S and III R consist only in the camera objectives employed. III L has a Hartmann-Zeiss 'chromat' objective; III S a Bausch and Lomb Zeiss-Tessar and III R a specially designed Ross homocentric. The form of field of all these three objectives and of the others used has been fully discussed and described in my report for 1908–9, p. 170.

Since my last report only changes in minor details of these instruments have been made. No material improvements have suggested themselves, as they all work satisfactorily. As will be mentioned more fully later, it is proposed to design and construct a grating spectrograph as soon as a grating giving a sufficiently bright first order spectrum has been obtained.

The method of measurement and reduction follows that already fully described in the report for 1906–7, p. 95, 1907–8, p. 84, and 1908–9, p. 175, so far as micrometer measures are concerned. The stereo-comparator has been used on the plates of ϵ Ursæ Minoris which have been measured and reduced as described in the 1908–9 report, p. 177. It may be as well to state that the method of reducing the micrometer measures which has been followed for five years has proved itself eminently satisfactory, requiring a minimum amount of labour—a couple of subtractions from tabular values to get the millimetre displacement, which latter is multiplied by a tabular velocity constant to give the radial velocity—and giving equal accuracy with other methods requiring several times the work.

The observing weather during the year covered by this report has been very poor, the worst on record since the Observatory was organized. This will be evident by a comparison of the spectra obtained in the last three years; details of which are given in the annexed table.

SPECTRA OBTAINED.

Month.	1908–9		1909–10		1910–11	
	Spectra.	Nights.	Spectra.	Nights.	Spectra.	Nights.
April	65	8	77	11	51	14
May	49	11	22	5	44	10
June	90	16	49	12	41	11
July	108	20	94	15	49	11
August	100	16	77	16	55	10
September	43	8	59	12	103	17
October	47	8	94	13	76	11
November	38	9	57	11	23	5
December	99	15	94	14	101	13
January	129	18	84	11	68	10
February	102	15	89	12	53	12
March	141	14	115	15	118	16
Totals	1011	158	911	147	782	140

It will be noticed that not only have the number of spectra and the number of nights steadily decreased, but the average number of spectra obtained per night has decreased from 6.4 in 1908–9 to 6.2 in 1909–10 and to 5.6 in 1910–11.

Of the 782 spectra obtained during the past year, 111 are of the binaries completed during the year, 524 are of binaries under observation, 75 of binaries, work on which has been discontinued, 50 are additional plates of binaries previously completed in which for various reasons it was felt desirable to obtain further observation, and 22 are spectra of various stars obtained for miscellaneous purposes.

There have been completed, during the interval covered by this report, the elements of the orbits of five spectroscopic binaries, some details of which are given in the annexed table.

DATA OF BINARIES COMPLETED.

Star.	R. A. 1900.	Decl. 1900.	Visual Mag.	Type.	No. of Plates used.	Computer.
	h. m.	° ′				
7 Camelopardalis	4 49·3	+53 35	4·44	A2	44	W. E. Harper.
ν Orionis	6 1·9	+14 47	4·40	B2	117	"
ω Ursæ Majoris	10 48·2	+43 43	4·84	A	60	T. H. Parker.
93 Leonis	11 42·8	+20 46	4·54	F8	72	J. B. Cannon.
ϵ Ursæ Minoris	16 56·2	+82 12	4·40	G5	42	J. S. Plaskett.

ELEMENTS OF ORBITS.

Star.	Period.	e	K	ω	γ	Julian Day.	$a \sin i$
	days.		km.	°	km.		km.
7 Camelop.	3·8846	·013	35·15	217·14	− 8·93	2418281·176	1877000
ν Orionis	131·26	·599	34·09	1·58	+22·10	2417975·16	49270000
ω Ursæ Majoris	15·840	·264	20·64	11·95	−18·45	2417991·101	4336000
93 Leonis	71·70	·008	26·54	270·81	+ 0·17	2418088·405	26170000
ϵ Ursæ Minoris	39·482	·0113	31·954	359·76	−11·398	2418005·75	17346000

Complete data including measures will be given of these five spectroscopic binaries later, of ε Ursæ Minoris above my own signature and of the other four in the Appendices A, B and C to this report above the signatures of the observers who measured the plates and computed the orbits. Although there is a reduction from last year in the number of orbits published, from eight to five, this reduction is perhaps more apparent than real, for only three of the eight of last year were new orbits, the remainder being new discussions of previously published results to which further data had in some cases been added. However, a reduction in the number of orbits is to be expected from two reasons—first, on account of the poorer observing weather and fewer spectra obtained, and second, because of the fact that the brighter spectroscopic binaries are rapidly becoming exhausted and it is necessary to observe fainter stars requiring more exposure time. This last cause will tend to become more serious as time goes on, for the number of spectroscopic binaries brighter than the fifth magnitude, which is approaching the practical limit with our equipment, is rapidly becoming smaller. There is a still further reason which leads us to expect that the number of orbits obtained must necessarily decrease, and that is the fact that the binaries selected for observation first, are those in which a large range of velocity combined with lines suitable for fairly accurate measurement enables the elements of the orbit to be comparatively easily determined. As time goes on, however, and selection has to be made from stars whose spectra are poor or which have only a small range of velocity, it is evident that many more plates will be required to obtain a satisfactory orbit even if it is possible to determine the orbit at all. In previous reports I have mentioned the abandonment of work on two binaries, δ Aquilæ and ο Andromedæ. As stated above, 75 spectra were obtained of eight stars on which work has been discontinued for the reasons stated above, and, although it by no means follows that the orbits of these stars cannot be determined, yet, as we have 23 binaries under observation where the chances of securing orbits with a reasonable number of plates seem greater, the others were discontinued for the present. In order to render the measures we have obtained available for others working along similar lines, who may desire to take up any of these binaries, it has been decided to publish these measures at once, and they will be found in Appendices A, B and C, given by the observers who have measured the plates. There are thus given the measures of 119 plates of 11 stars. For convenience, the principal data of the stars observed and the plates measured are collected in the following tables, while the observing records and detailed measures are given in the appendices just cited.

MISCELLANEOUS MEASURES.

Star.	R.A.		Dec.		Type.	Mag.	No. of Plates.	Measurer.
	h.	m.	°	′				
9 Camelopardalis.	4	44·1	+66	10	B	4·4	4	Cannon.
μ Orionis	5	56·9	+ 9	39	B3	3·4	2	Harper.
φ Ursæ Majoris	9	45	+54	32	A	4·7	1	"
π^3 Virginis	11	56	+ 7	06	A	4·6	2	"
ε Ursæ Majoris	12	49·6	+56	30	A*p*	1·7	2	"
α Ophiuchi	17	30·3	+12	38	A5	2·1	24	Cannon.
ζ Aquilæ	19	01	+13	43	A	3·3	12	Parker.
ι Cygni	19	27	+51	32	A	3·9	7	Cannon.
ν Cygni	20	53	+40	47	A	4·2	7	Parker.
ο Andromedæ	22	57·3	+41	47	B3	3·4	50	Harper.
σ Cassiopeiæ	23	54	+55	12	B5	5·1	8	Cannon.

SUMMARY OF MEASURES.

9 Camelopardalis.

Plate.	G. M. T. Date.	Year.	Velocity.	Plate.	G. M. T. Date.	Year.	Velocity.
2805	Sept. 20·78.....	1909	−6·4	2874	Oct. 8·79......	1909	−1·7
2842	Oct. 4·74.....	"	+2·2	2875	" 8·79......	"	−7·3
2874	" 8·79.....	"	+1·5	2875	" 8·79......	"	−7·4

μ Orionis.

Plate.	G. M. T. Date.	Year.	Velocity.	Plate.	G. M. T. Date.	Year.	Velocity.
1139	Nov. 11·88......	1907	+68·4	1159	Nov. 23·75......	1907	+50·3

φ Ursæ Majoris.

Plate.	G. M. T. Date.	Year.	Velocity.	Plate.	G. M. T. Date.	Year.	Velocity.
1476	April 13·72......	1908	−11·0				

π^8 Virginis.

Plate.	G. M. T. Date.	Year.	Velocity.	Plate.	G. M. T. Date.	Year.	Velocity.
3349	Mar. 18·88......	1910	−28·5	3383	Apr. 11·77......	1910	−20·2

ϵ Ursæ Majoris.

Plate.	G. M. T. Date.	Year.	Velocity.	Plate.	G. M. T. Date	Year.	Velocity.
456	Dec. 11·75......	1906	−0·4	489	Dec. 18·69......	1906	−7·0

α Ophiuchi.

Plate.	G. M. T. Date.	Year.	Velocity.	Plate.	G. M. T. Date.	Year.	Velocity.
1481	Apr. 13·86.....	1908	− 4·8	1752	July 31·68......	1908	+ 1·4
1542	May 18·83.....	"	+15·4	1765	Aug. 5·67......	"	+15·4
"	" 18·83.....	"	+ 0·1	1819	" 24·61......	"	+ 3·5
1549	" 22·83.....	"	+16·3	"	" "	"	−14·7
1612	June 17·81.....	"	+ 9·3	1834	" 27·55......	"	+ 2·3
"	" "	"	+ 5·6	1843	" 28·56......	"	+17·7
1632	" 24·74.....	"	+17·7	1854	" 31·61......	"	+28·5
1649	" 27·74	"	+13·1	1862	Sep. 3·55......	"	+ 8·3
1654	July 1·74.....	"	+15·9	1863	" 3·56......	"	+18·2
1688	" 10·71.....	"	+13·4	1884	" 14·56......	"	+ 2·8
1701	" 13·74.....	"	− 0·8	1885	" 14·57......	"	+23·0
1702	" 13·76.....	"	− 7·3	"	" "	"	+39·9
1715	" 15·79.....	"	− 0·1	1890	" 16·53......	"	+ 0·9
1724	" 24·60.....	"	+14·4	1891	" 16·55......	"	+ 3·9

o Andromedæ.

Plate.	G. M. T. Date.	Year.	Velocity.	Plate.	G. M. T. Date.	Year.	Velocity.
369	Aug. 6·80.....	1906	− 4	970	July 27·80......	1907	−10·8
374	" 8·81.....	"	− 1	977	Aug. 1·77......	"	+ 5·3
379	" 15·77.....	"	− 4	984	" 5·77......	"	−17·3
401	Sep. 27·69.....	"	0	999	" 8·76......	"	−22·1
410	Oct. 16·71.....	"	− 8	1002	" 10·70......	"	−10·9
414	" 23·64.....	"	− 2	1008	" 12·75......	"	−24·9
419	Nov. 1·74.....	"	−20	1021	" 22·78......	"	−30·4
432	" 8·71.....	"	−11	1035	Sep. 6·70......	"	−13·8
439	" 19·60.....	"	−13	1042	" 12·82......	"	−17·5
450	Dec. 11·53.....	"	−10	1044	" 14·78......	"	− 9·2
462	" 13·61.....	"	−15	1052	" 18·71......	"	−12·8
482	" 18·46.....	"	−24	1053	" 18·74	"	−24·5
491	" 19·53.....	"	−30	1065	" 20·71......	"	−16·1
526	Jan. 11·55.....	1907	−19	1066	" 20·75......	"	−11·7
531	" 15·47.....	"	−19	1087	Oct. 1·67......	"	−16·8
538	" 16·60.....	"	−13	1088	" 1·69......	"	− 6·6
865	June 14·84.....	"	−12·9	1130	Nov. 8·65......	"	− 5·2
867	" 20·81.....	"	− 5·9	1131	" 8·68......	"	−15·4
874	" 21·83.....	"	−12·9	1133	" 11·62......	"	− 2·0
899	" 27·82.....	"	−17·0	1134	" 11·65......	"	−19·6
907	July 2·83.....	"	− 4·7	1151	" 18·57......	"	− 7·9
935	" 9·82.....	"	− 9·0	1152	" 18·62......	"	− 9·9
948	" 16·77.....	"	−10·4	1174	Dec. 4·65......	"	−15·6
954	" 18·75.....	"	−19·7	1175	" 4·67......	"	−18·7
960	" 20·79.....	"	−20·6	1176	" 4·70......	"	−15·5

ζ Aquilæ.

Plate.	G. M. T. Date	Year.	Velocity.	Plate.	G. M. T. Date.	Year.	Velocity.
805	May 31·83.....	1907	−29·6	1802	Aug. 20·72.....	1908	− 26·5
852	June 14·77.....	"	−34·0	1821	" 24·66.....	"	− 14·8
864	" 20·76.....	"	−41·4	" *p*	" "	"	+111·0
947	July 16·73.....	"	−31·0	" *s*	" "	"	− 26·9
1039	Sep. 12·67.....	"	−22·3	" *p*	" "	"	+116·3
1644	June 26·85.....	1908	−18·0	" *s*	" "	"	− 21·7
1680	July 8·82.....	"	−68·4	1856	" 31·63.....	"	− 16·3
"	" "	"	−37·1	1887	Sep. 14·61.....	"	− 8·2
1778	Aug. 7·78.....	"	−50·1	....	....	......	....

p Primary. *s* Secondary.

ι Cygni.

Plate.	G. M. T. Date.	Year.	Velocity.	Plate.	G. M. T. Date.	Year.	Velocity.
932	July 9·74.....	1907	−20·2	1824	Aug. 24·76.....	1908	−18·7
1718	" 15·85.....	1908	− 4·7	1839	" 27·70.....	"	−15·9
1804	Aug. 20·76.....	"	−20·9	1845	" 28·63.....	"	−21·0
"	" "	"	−19·9	1886	Sep. 14·61.....	"	−22·0
1824	" 24·76.....	"	−23·1	....	....	......	....

ν Cygni.

Plate.	G. M. T. Date	Year.	Velocity.	Plate.	G. M. T. Date.	Year.	Velocity.
934	July 9·78.....	1907	−46·6	1825	Aug. 26·81.....	1908	− 5·1
1758	" 31·83.....	1908	−35·6	1846	" 28·67.....	"	−19·2
1830	Aug. 24·81.....	"	−32·4	1857	" 31·72.....	"	−57·0
"	" "	"	−10·8	1892	Sep. 16·59.....	"	−29·1

σ Cassiopeiæ.

Plate.	G. M. T. Date.	Year.	Velocity.	Plate.	G. M. T. Date.	Year.	Velocity.
2660	July 14·86.....	1909	−21·3	2902	Oct. 20·70.....	1909	−28·7
2680	" 27·83.....	"	−21·8	"	" "	"	−30·0
2784	Sep. 14·57.....	"	−16·6	3009	Dec. 2·42.....	"	−38·8
2839	Oct. 4·66.....	"	+ 4·9	3521	July 11·77.....	1910	+ 6·0
"	" "	"	+ 3·6	3527	" 13·73.....	"	−25·6

The spectroscopic binaries under investigation are contained in the following table. The arrangement given here is arbitrary following the order in which the stars were selected from the observing list.

ρ Leonis	b Persei
β Coronæ Borealis	ξ Persei
72 Ophiuchi	τ Orionis
γ Corvi	ν Geminorum
d Boötis	γ Geminorum
B. A. C. 5890	86 ρ Tauri
γ Aquarii	23 Comæ
ϵ Cygni	a Pegasi
ϵ Cassiopeiæ	σ Geminorum
θ^2 Tauri	68 Ophiuchi
69 (v) Tauri	γ Ophiuchi
ξ Tauri	

The above list includes the majority of the discovered binaries (whose orbits are undetermined and which are not under observation at other places) in which the range of velocity and character of the spectrum offer a reasonable chance of obtaining an orbit. In the other 200 or so spectroscopic binaries, the chances of obtaining satisfactory orbits, or even any orbit at all, are, in the majority of cases, poor. This is owing chiefly, as stated above, to a total range of velocity not sufficiently greater than the probable error of measurement to allow the period to be easily determined. If the period were known it is likely that a sufficient number of observations would enable a fairly satisfactory orbit to be obtained.

The method of selection of binaries for observation depends then, first, on the character of spectrum or type of star, and second, on the range of velocity observed. A low range is evidently due either to a long period or to a small inclination of the orbital plane to the tangent plane, to the sphere, or to a combination of both causes. There is an objection to such a method of selection of stars, that the material obtained will not be representative of the stars as a whole, and that general conclusions

cannot safely be drawn from the discussion of data limited in this peculiar way. But under present conditions such a method of selection cannot well be remedied, as, even in the cases which are apparently most suitable, it is sometimes difficult to secure an orbit and it would be simply a waste of time to obtain observations on many of the discovered binaries. Indeed, in my opinion, judging from our experience with early type spectra, the range of velocity obtained in many of the published binaries is insufficient to prove that they are binaries.

It is evident from the foregoing that our output in radial velocity observations of spectroscopic binaries is likely to diminish materially under present conditions, instead of increasing as is to be wished. The only remedy for this state of affairs is an increase in telescope aperture. Such an increase would not only enable us to keep up our work on spectroscopic binaries but to take part in the great work of obtaining the radial velocities of the fainter stars, a work than which none is more urgent and none offers greater returns for the labour expended. As is well known, the radial velocities of all stars with spectra reasonably accurately measurable, brighter than 5.0 visual magnitude are now practically completed by the ability and energy of Dr. W. W. Campbell, director of the Lick Observatory. But the radial velocities of stars fainter than 5.0 visual magnitude are needed, and there seems no immediate prospect of obtaining them. If our Observatory could take part in such work it would place it in the first rank among observatories, and would undoubtedly give Canada a very high standing in the scientific world.

The desired increase in telescopic aperture can be most economically obtained by the use of a reflecting telescope, which can be erected for less than a quarter the cost of a refractor of the same aperture, and which, for spectroscopic use, is almost equally efficient and indeed possesses some advantages over the refractor, notably in that it is perfectly achromatic and that the shorter, photographic, wave lengths of light are not absorbed to the same extent as when passing through glass. As to the size of aperture desirable I would say, after the performance of the 5-foot reflector on Mount Wilson, that we should not be satisfied with a smaller aperture, but, on the contrary, perhaps aim at something greater, 6-foot say, which would give us the distinction of having the largest in the world, and, a far more important consideration, enable us to reach fainter stars and to obtain sufficient exposure on the brighter ones in considerably less time. The question of covering such an instrument by a movable roof, which can be rolled back out of the way when obvervations are to be made, instead of by the ordinary dome, is worth considering, for, if a suitable wind shield could be devised, there is a decided advantage so far as the seeing is concerned in working in the open, and, in addition, a building with a movable roof would only cost a small fraction of one with a dome.

I would, therefore, strongly urge upon you the desirability of the installation of a large reflecting telescope principally for radial velocity investigations, though it would be desirable to make it suitable for other lines of work also, especially as this can be done without much additional cost. Such an instrument would place our Observatory in the first rank, so far as equipment goes, among observatories, and would enable our staff, who have already obtained an enviable record for the quantity and quality of the work done with a very modest equipment, to excel that record and to place our Observatory in the forefront in the production of valuable scientific work. There is, as I have previously stated, a pressing need for just the kind of work that we would be best prepared to do with such a telescope, and our taking up of this work would add much to our prestige as an Observatory and as a nation. It may not be amiss to point out that, as it would take two or three years to construct such a telescope, all that would be necessary in the meantime would

be to have its construction authorized, no money would require to be voted for the present. Some further remarks concerning this question will be found under the report of my attendance at the two notable astronomical meetings of last year.

The only spectroscopic binary on which the measures and discussion have been made by myself is the last in the preceding list, ϵ Ursæ Minoris, whose orbit will now be given, those of the others appearing in the appendices.

The Spectroscopic Binary ϵ Ursæ Minoris.

The star ϵ Ursæ Minoris ($\alpha = 16^h 56.2^m, \delta = +82° 12'$) was announced to be variable in its velocity by Professor Campbell in 1899.* It was placed on our observing list with the three-prism spectrograph in 1908 and a few plates were obtained. The star, however, is so faint—photographic magnitude 5·3—that even two and one half hours' exposure gave only a very weak spectrum, quite unsuitable for accurate measurement. When a short-focus camera was applied to the three-prism spectrograph in 1909, the star was again observed, and although greater intensity of spectrum was obtained the exposure time was inconveniently long. If the Lumiere "Sigma" plates were used, a fair spectrum could be obtained in an hour if the night was reasonably good, but these plates have the disadvantage of being very coarse grained, thus diminishing considerably the ease and accuracy of measurement. Consequently, the spectra obtained were not felt to be of satisfactory quality, and after May, 1910, the star was observed with the new single-prism spectrograph on Seed "27" plates. Even with this low dispersion over an hour's exposure was required, and many of the spectra obtained were of poor quality. It almost seemed, therefore, that this star was below the effective range of our equipment, and it was thought preferable to work up the plates already obtained, even if of inferior quality, than to attempt to obtain good high dispersion plates of so faint an object. Of the 55 plates obtained of this star, 42 of the best were selected for use in determining the orbit, but the majority even of these 42 were not of good quality.

The star is of the spectral class G5 with good lines only slightly advanced in type beyond the sun, and consequently well adapted for the employment of the spectro-comparator, on which all the plates were measured and which is quite a satisfactory method for stars of this type. The record of observations is given below, followed immediately by the detailed measures which are placed in a similar form to that described above for those measured on the micrometer microscope.

As has been described in the two previous reports, the spectro-comparator determines the actual linear displacement of the star lines relatively to the displacement of the lines in a spectrum of the sun. The measurements of these lines are made at a number of selected regions of the spectrum, and the number of these regions measured varies from plate to plate, depending on the quality. In the tables of measures the wave length of the centre of the region is given in the first column and the kilometre values of the measured displacements in the succeeding columns. The tables are grouped so that the measures of plates made on each form of the spectrograph, of which III L, III S, III R and I were employed, are kept together, the spectrograph used being indicated at the head of the table.

* Astrophysical Journal, Vol. X., p. 179, October 1899.

RECORD OF SPECTROGRAMS.

P. Plaskett.
H. Harper.
P¹. Parker.
C. Cannon.

Star.	No. of Neg.	Camera	Plate.	Date.	Middle of Exposure G.M.T.	Duration	Hour Angle at End.	Temperature Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width in Inches.	Seeing.	Observer	Remarks.
				1908.	h m	m	h m								
εUrsæ Minoris	1418	III L	Seed 27	Mar. 20	17 17	115	3 50 E	− 5·2	− 6·0	0·9	1·0	·0018	Fair	P	Hazy 30ᵐ
"	1454	"	"	Apr. 3	17 33	115	2 45 E	− 7·5	− 9·0	1·7	1·7	·0017	....	P	
"	1516	"	"	May 4	20 22	110	2 05 W	7·2	6·3	13·4	13·4	·0018	....	P	
"	1530	"	"	" 15	17 20	120	0 05 E	14·5	13·5	18·7	18·7	"	Good	P–H	
"	1555	"	"	" 25	18 30	160	2 05 W	19·6	16·0	25·5	25·7	"	....	P¹–H	Off 45ᵐ
"	1587	"	"	June 6	19 02	135	3 00 W	20·5	19·8	25·2	25·3	"	Fair	P	
"	1868	"	"	Sept. 7	14 52	135	5 10 W	17·4	15·0	21·1	21·1	·0015	"	P	
				1909.											
"	2917	III S	"	Oct. 29	14 00	100	7 20 W	3·0	1·5	7·0	7·0	·002	5	H	
"	3023	"	Σ	Dec. 11	10 34	72	6 30 W	− 3·8	− 4·8	− 1·4	− 1·6	·0016	3–4	P	
"	3042	"	"	" 18	11 00	80	....	− 4·0	− 5·5	− 3·2	− 3·2	"	"	P	
"	3053	"	"	" 27	10 29	75	7 30 W	− 7·5	− 9·4	− 5·9	− 6·0	"	"	P	
"	3067	"	"	" 30	11 15	70	8 25 W	− 8·0	− 8·6	− 3·0	− 3·1	"	4	P	
				1910.											
"	3081	"	"	Jan. 4	11 10	70	8 40 W	−15·5	−15·0	− 9·5	− 9·5	·002	3	P	
"	3084	"	"	" 7	10 45	70	8 25 W	......	......	......	......	"	3	P	Temperature uncertain.
"	3117	"	"	" 15	11 05	80	9 20 W	− 9·5	− 9·0	− 1·0	− 1·1	·0016	3–4	P	
"	3131	"	"	" 19	11 21	77	9 55 W	− 1·0	− 1·7	2·5	2·5	"	"	P	
"	3151	"	"	" 25	23 30	60	1 40 E	− 9·8	−10·5	− 5·2	− 5·3	"	"	P	
"	3183	"	"	Feb. 10	17 37	75	6 25 E	−15·8	−16·1	− 6·9	− 6·9	"	4	P	
"	3224	"	"	" 24	15 37	80	7 35 E	−13·5	−14·0	0·0	0·3	·0017	4–5	H	
"	3292	III R	"	Mar. 5	19 40	70	2 50 E	1·2	0·5	10·6	10·6	"	3	P	
"	3310	"	"	" 10	17 15	60	5 00 E	− 1·1	− 1·4	9·4	9·4	·002	4	P	

RECORD OF SPECTROGRAMS.—*Concluded.*

P. Plaskett.
H. Harper.
P[1]. Parker.
C. Cannon.

Star.	No. of Neg.	Camera	Plate.	Date.	Middle of Exposure. G.M.T.	Duration	Hour Angle at End.	Temperature. Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width in Inches.	Seeing.	Observer	Remarks
				1910.	h m	m	h m								
ε Ursæ Minoris	3326	III R	Σ	Mar. 11	21 50	90	0 05 E	− 2·0	− 3·4	3·0	2·9	·0017	5–4	P[1]	
"	3337	"	"	" 17	16 40	70	5 00 E	− 9·6	−10·0	1·5	1·6	·0018	3–4	P	
"	3359	"	"	" 26	19 05	110	1 40 E	3·0	2·5	7·1	7·1	·002	3–4	P	Off 20[m]
"	3372	"	"	Apr. 2	18 40	80	1 55 E	6·0	4·5	12·5	12·5	"	"	P	
"	3426	I	Seed 27	May 5	16 32	75	1 50 E	9·0	8·5	14·4	14·4	"	"	P	
"	3427	III R	Σ	" 5	18 05	70	0 30 E	8·5	8·0	12·5	12·5	"	"	P	
"	3435	I	Seed 27	" 7	18 26	57	0 05 E	13·1	12·6	18·2	18·2	"	3	P	
"	3439	"	"	" 10	18 47	55	0 30 W	9·6	9·0	15·7	15·7	"	4	C	
"	3448	"	"	" 12	16 22	75	1 35 E	6·0	6·7	17·7	17·6	"	3–4	P	Off 15[m]
"	3455	"	"	" 19	16 52	75	0 45 E	11·8	10·5	17·9	17·8	"	4	P	Off 15[m]
"	3461	"	"	" 27	20 28	33	3 05 W	11·0	11·0	17·0	17·8	"	3	P[1]	
"	3463	"	"	" 28	16 55	60	0 10 E	17·6	17·0	23·6	23·6	"	3	P	
"	3470	"	"	June 4	17 12	95	0 50 W	10·0	9·5	21·9	22·2	"	4	P	Off 25[m]
"	3476	"	"	" 9	18 01	57	1 45 W	12·0	12·5	19·8	20·2	"	4	P[1]	
"	3492	"	"	" 23	16 40	80	1 30 W	18·4	16·5	27·7	27·7	"	2–3–4	P	
"	3495	"	"	" 25	16 50	80	1 50 W	19·2	18·5	25·0	24·9	"	3	P	
"	3554	"	"	Aug. 2	18 37	115	6 15 W	18·1	17·0	22·8	22·4	"	0–1–3	P[1]	
"	3566	"	"	" 11	16 50	70	5 00 W	19·2	17·8	23·6	23·6	"	4	P	Off 15[m]
"	3611	"	"	Sept. 1	16 12	96	5 43 W	14·0	12·0	20·8	20·4	"	4 5	H	
"	3630	"	"	" 9	14 13	80	4 05 W	......	......	15·9	15·8	"	4	C	
"	3732	"	"	Oct. 12	13 25	64	5 20 W	3·5	2·6	10·4	10·1	"	5	P[1]	

COMPARATOR MEASURES OF ε URSÆ MINORIS (III L).

Centre of Region	1418 Vel.	1454 Vel.	1516 Vel.	1536 Vel.	1555 Vel.	1587 Vel.	1868 Vel.
4669·0	−35·31	− 6·92	−38·53	+ 6·92	....	−36·06	−22·23
4628·7	32·12	1·43	38·08	7·14	+20·47	37·60	23·32
4590·2	35·33	1·18	39·02	7·82	23·18	30·30	25·25
4554·6	33·90	2·66	39·00	9·32	21·05	33·24	22·60
4523·9	33·52	7·30	39·53	8·16	22·55	33·52	21·48
4492·0	32·20	6·65	35·33	7·90	22·42	32·01	21·20
4460·3	31·31	5·22	35·35	9·24	19·06	23·70	26·11
4429·6	35·32	....	36·11	10·10	20·20	....	....
4402·1	31·03	....	....	9·03	22·93	....	....
4374·5	37·12	....	....	10·94	22·40	....	....
4346·5	....	....	....	8·10	21·60	....	....
4322·8	....	....	....	10·25	20·16	....	....
Weighted mean	−33·40	− 4·48	−37·62	+ 8·84	+21·47	−32·60	−23·17
V_a	− 8·18	− 8·21	− 6·64	− 5·63	− 4·54	− 3·07	+ 7·59
V_d	+ 0·03	+ 0·03	− 0·01	+ 0·03	− 0·01	− 0·02	− 0·03
Correction to Standard	+ 0·35	+ 0·35	+ 0·35	+ 0·35	+ 0·35	+ 0·35	+ 0·35
Radial Velocity	−41·2	−12·3	−43·9	+ 3·6	+17·3	−35·3	− 15·3

COMPARATOR MEASURES OF ε URSÆ MINORIS (III S).

Centre of Region.	2917 Vel.	3023 Vel.	3042 Vel.	3053 Vel	3067 Vel.	Vel.
4669·0	−22·35	....	....	....	....	....
4628·7	25·51	−34·57	....	+ 3·29	....	+28·80
4590·2	20·52	33·94	−41·83	+ 1·58	+11·05	26·83
4554·6	24·27	32·62	42·48	− 1·52	12·14	18·20
4523·9	24·16	35·14	46·12	+ 1·46	9·52	19·77
4492·0	25·39	35·97	43·72	− 5·64	5·64	16·92
4460·3	23·75	35·29	43·44	− 2·04	6·21	....
4429·6	26·08	32·59	46·94	·00	11·73	....
4402·1	26·50	35·97	46·06	− 1·26	10·73	....
4374·5	27·40	37·14	46·27	− 1·83	10·96	....
4346·5	28·15	36·36	45·75	− 5·28	....	....
4322·8	24·42	34·64	42·58	− 1·70	....	....
4298·2	24·15	....	....	− 6·03	....	....
Weighted mean	−24·82	−34·93	−44·52	− 1·58	+ 9·75	+22·10
V_a	+ 7·26	+ 2·62	+ 1·63	+ 0·32	− 0·12	− 0·86
V_d	− 0·04	− 0·04	− 0·04	− 0·04	− 0·04	− 0·04
Correction to Standard	− 0·30	− 0·30	− 0·30	− 0·30	− 0·30	− 0·30
Radial Velocity	− 17·9	− 32·6	− 43·2	− 1·6	+ 9 ·3	+ 20·9

COMPARATOR MEASURES OF ε URSÆ MINORIS (III S).

Centre of Region.	3084 Vel.	3117 Vel.	3131 Vel.	3151 Vel.	3183 Vel.	3224 Vel.
4628·7	+23·04	−13·17	−30·45	−39·46	....	....
4590·2	17·36	9·57	27·62	36·41	+23·68	−15·39
4554·6	18·20	12·14	26·55	38·07	22·75	12·14
4523·9	21·96	13·18	29·28	35·26	22·70	12·08
4492·0	23·98	12·69	25·39	36·65	23·27	13·75
4460·3	23·08	11·54	27·15	33·90	23·75	14·93
4429·6	20·21	10·43	24·77	35·34	21·51	10·43
4402·1	22·09	10·10	25·24	35·92	25·67	13·88
4374·5	20·70	11·57	28·00	37·54	24·96	....
4346·5	....	9·97	28·74	35·05	....	....
4322·8	....	11·93	28·39	36·22	....	....
4298·2	....	13·72	30·73	37·12	....	....
Weighted mean	+21.18	−11·63	−27·52	−36·53	+23·54	−13·53
V_a	− 1·29	− 2·44	− 2·99	− 3·85	− 5·67	− 6·99
V_d	− 0·04	− 0·04	− 0·04	+ 0·02	+ 0·04	+ 0·04
Correction to Standard	− 0·30	− 0·30	− 0·30	− 0·30	− 0·30	− 0·30
Radial Velocity	+ 19·5	− 14·4	− 30·8	− 40·7	+ 17·7	− 20·2

COMPARATOR MEASURES OF ε URSÆ MINORIS (III R).

Centre of Region.	3292 Vel.	3310 Vel.	3326 Vel.	3337 Vel.	3359 Vel.	3372 Vel.	3427 Vel.
4588·3	−34·51	−26·68	− 9·66	+10·14	+33·60	− 0·92	+24·40
4538·0	34·47	22·26	16·66	9·17	31·40	+ 5·68	27·50
4489·5	33·58	27·77	17·83	10·77	35·21	+ 1·66	26·12
4439·8	33·71	28·60	21·15	12·55	29·40	+ 4·32	24·31
4398·1	33·61	27·28	14·96	10·47	29·13	+ 3·74	27·30
4356·8	33·42	21·83	22·05	11·37	29·52	+ 4·98	28·78
4316·6	36·19	24·71	18·30	8·46	25·04	− 1·69	22·34
4276·2	36·30	23·77	....	9·00	25·40	+ 1·29	27·00
4239·3	35·82	23·27	....	....	....	+ 3·98	....
4209·9	32·97	....	....	....	....	....	....
Weighted mean	−34·39	−24·97	−17·47	+10·41	+29·52	+ 2·77	+25·99
V_a	− 7·60	− 7·85	− 7·90	− 8·10	− 8·25	− 8·23	− 6·60
V_d	+ 0·03	+ 0·04	+ 0·01	+ 0·04	+ 0·02	+ 0·02	+ 0·01
Correction to Standard	+ 0·26	+ 0·26	+ 0·26	+ 0·26	+ 0·26	+ 0·26	+ 0·26
Radial Velocity	− 41·8	− 32·5	− 25·1	+ 2·3	+ 21·5	− 5·4	+ 19·6

COMPARATOR MEASURES OF ε URSÆ MINORIS (I).

Centre of Region.	3426 Vel.	3435 Vel.	3439 Vel.	3448 Vel.	3455 Vel.	3461 Vel.	3463 Vel.
4590	....	+15·74	....	− 7·52	−33·54	−37·65	−28·75
4525	+27·57	11·82	+ 9·20	7·22	41·40	30·85	21·67
4464	28·90	19·50	10·70	1·89	36·51	28·95	25·80
4403	27·20	18·15	11·48	·00	31·43	29·01	24·80
4349	30·25	16·60	4·65	1·16	34·91	27·35	26·20
4290	29·06	21·26	6·71	7·83	36·32	37·50	30·21
4244	28·01	17·23	2·69	8·62	35·02	....	30·73
4199	31·70	20·30	5·20	7·01	35·39	....	22·89
4148	31·03	18·12	....	5·77	35·20	....	....
4101	24·53	18·77	....	....	34·68	....	....
Weighted mean	+28·40	+18·07	+ 7·05	− 5·00	−35·40	−31·85	−26·42
V_a	− 6·60	− 6·43	− 6·16	− 5·98	− 5·04	− 4·35	− 4·25
V_d	+ 0·02	+ 0·01	·00	+ 0·02	+ 0·02	− 0·02	+ 0·01
Correction to Standard	+ 0·26	+ 0·26	+ 0·26	+ 0·26	+ 0·26	+ 0·26	+ 0·26
Radial Velocity	+ 22·1	+11·9	+ 1·1	− 10·7	− 40·2	− 36·0	− 30·4

COMPARATOR MEASURES OF ε URSÆ MINORIS (I).

Centre of Region.	3470 Vel.	3476 Vel.	3492 Vel.	3495 Vel.	3554 Vel.	3566 Vel.	3611 Vel.
4590	+ 5·48	....	....	−23·98	−27·40	....	+ 2·05
4525	2·62	+14·44	−21·67	24·94	29·53	−36·73	5·91
4464	1·26	17·00	25·80	26·42	30·20	51·00	8·81
4403	3·02	19·37	20·57	27·21	28·42	49·59	9·15
4349	1·75	14·55	20·94	27·91	31·41	49·45	9·35
4290	·00	19·57	18·45	29·62	30·74	47·52	4·47
4244	·54	12·93	21·01	26·93	28·55	44·16	10·70
4199	6·76	20·29	20·28	27·02	27·04	49·92	10·40
4148	1·50	18·02	21·53	....	28·04	....	6·51
4101	....	....	17·31	....	....	....	10·51
Weighted mean	+ 2·58	+17·22	−20·71	−26·91	−29·01	−47·04	+ 7·90
V_a	− 3·39	− 2·75	− 0·88	− 0·61	+ 4·38	+ 5·38	+ 7·20
V_d	·00	− 0·01	− 0·01	− 0·01	− 0·03	+ 0·02	− 0·02
Correction to Standard	+ 0·26	+ 0·26	+ 0·26	+ 0·26	+ 0·26	+ 0·26	+ 0·26
Radial Velocity	− 0·5	+ 14·7	− 21·3	−27·3	− 24·4	− 41·4	+ 15·3

COMPARATOR MEASURES OF ε URSÆ MINORIS (I).

Centre of Region.	3630 Vel.	3732 Vel.	Vel.	Vel.	Vel.	Vel.	Vel.
4590	−23·30	− 5·48	....	....	....	....	....
4525	28·87	+ 3·94	....	....	....	....	....
4464	27·89	+ 7·55	....	....	....	....	....
4403	27·81	+ 3·02	....	....	....	....	....
4349	23·27	+ 2·91	....	....	....	....	....
4290	24·60	− 2·80	....	....	....	....	....
4244	24·80	+ 2·15	....	....	....	....	....
4199	20·80	+ 1·56	....	....	....	....	....
4148	26·04	....	....	....	....	....	....
Weighted mean	−25·14	+ 1·63	....	....	....	....	....
V_a	+ 7·67	+ 8·09	....	....	....	....	....
V_d	− 0·02	− 0·03	....	....	....	....	....
Correction to Standard	+ 0·26	+ 0·26	....	....	....	....	....
Radial Velocity	−17·2	+ 10·0	....	....	....	....	....

Collecting together the above measures we have the following table in which, in addition to the plate number, the dispersion, the Julian date, and the velocity, we have the phase and the residual (O-C) computed from the final elements.

MEASURES OF ϵ URSÆ MINORIS.

Plate Number.	*Dispersion.	Julian Date.	Phase.	Velocity.	Residual O - C.
1418	III L	2,418,021·72	21·72	−41·2	− 3·7
1454	"	035·73	35·73	−12·3	− 2·0
1516	"	066·85	27·368	−43·9	− 2·15
1530	"	077·73	38·248	+ 3·6	+ 1·2
1555	"	087·77	8·806	+17·3	+ 0·2
1587	"	099·79	20·826	−35·3	− 0·6
1868	"	192·62	34·992	−15·3	− 1·5
2917	III S	609·58	17·35	−17·9	+ 2·3
3023	"	652·44	20·728	−32·6	+ 1·8
3042	"	659·46	27·748	−43·2	− 2·0
3053	"	668·44	36·728	− 1·6	− 3·5
3067	"	671·47	0·276	+ 9·3	+ 0·6
3081	"	676·47	5·276	+20·9	+ 0·15
3084	"	679·45	8·256	+19·5	+ 1·1
3117	"	687·46	16·266	−14·4	+ 0·6
3131	"	691·47	20·276	−30·8	+ 1·9
3151	"	697·98	26·786	−40·7	+ 1·7
3183	"	713·73	3·054	+17·7	·0
3224	"	727·65	16·974	−20·2	− 1·8
3292	III R	736·82	26·144	−41·8	+ 1·0
3310	"	741·72	31·044	−32·5	− 0·6
3326	"	742·91	32·234	−25·1	+ 1·9
3337	"	748·70	38·024	+ 2·3	+ 1·0
3359	"	757·79	7·632	+21·5	+ 2·1
3372	"	764·78	14·622	− 5·4	+ 1·1
3426	I	797·69	8·05	+22·1	+ 3·4
3427	III R	797·75	8·11	+19·6	+ 1·0
3435	I	799·77	10·13	+11·9	− 1·4
3439	"	802·78	13·14	+ 1·1	+ 0·1
3448	"	804·69	15·05	−10·7	− 2·1
3455	"	811·70	22·06	−40·2	− 1·7
3461	"	819·85	30·21	−36·0	− 1·0
3463	"	820·70	31·06	−30·4	+ 1·4
3470	"	827·72	38·08	− 0·5	− 2·1
3476	"	832·75	3·628	+14·7	− 4·2
3492	"	846·70	17·578	−21·3	·0
3495	"	848·70	19·578	−27·3	+ 2·6
3554	"	886·77	18·166	−24·4	+ 0·6
3566	"	895·70	27·096	−41·4	+ 0·7
3611	"	916·67	8·584	+15·3	− 2·2
3630	"	924·52	16·434	−17·2	− 1·6
3732	"	957·56	9·992	+10·0	− 3·7

* III L 10·1, III S 18·6, III R 20·2, I 33·4 tenth-metres per mm. at H_γ.

The period was soon seen to be in the neighbourhood of 40 days, and, when all the observations were plotted and compared with the early measures of Campbell in 1897 and 1899, the period was finally accurately determined as 39.482 days, which can hardly be in error more than one figure in the last place. The initial epoch was taken as Julian Day 2,418,000 and with this and the period of 39.482 days the phases given in the fourth column were computed.

As it was intended to apply a least-squares correction to the graphically determined orbit, the above 42 plates were collected into 14 normal places well distributed over the velocity curve and with no great difference of phase in any one group. Through these normal places various velocity curves with slightly differing values of the elements were rapidly drawn by your graphical method. The curve best fitting the observations had the following values for elements:—

Period, $U = 39.482$ days
Eccentricity, $e = 0.05$
Half Amplitude, $K = 32.0$ km.
Long. of Apse, $\omega = 0°$
Time of Periastron, $T = 5.75$ days = Julian Day 8,005.75
Velocity of System, $\gamma = -12.1$ km.
Greatest Positive Velocity, $N_1 = +21.5$
" Negative " $N_2 = -42.5$.

The phase from periastron of the normal places given in the table below was obtained from the above value of the time of periastron passage, and the preliminary residuals were computed from the above elements by the help of Astrand's tables.

NORMAL PLACES OF ϵ URSÆ MINORIS.

No. of Group.	Phase.	Phase from Periastron.	Velocity.	Residual Preliminary	Residual Corrected.	Wt.	Eph.-Eqn.
1	7·907	2·157	+20·86	−1·70	−1·79	$\frac{1}{2}$	+·03
2	8·586	2·836	+17·70	−0·08	+0·01	$\frac{2}{3}$	−·05
3	10·084	4·334	+11·27	+1·49	+2·24	$\frac{1}{3}$	−.08
4	14·128	8·378	− 3·23	−2·83	−0·68	$\frac{1}{3}$	−·05
5	16·056	10·306	−14·80	−1·03	+1·17	$\frac{1}{2}$	+·13
6	17·392	11·642	−19·83	−2·42	−0·47	$\frac{3}{4}$	+·06
7	20·106	14·356	−31·58	−1·53	−0·56	$\frac{1}{2}$	+·04
8	21·132	15·382	−35·92	−0·38	+0·22	$\frac{2}{3}$	+·07
9	27·021	21·271	−42·39	+0·57	+0·13	1	·00
10	31·267	25·517	−31·06	−0·74	−0·04	$\frac{3}{4}$	+·07
11	35·361	29·611	−13·80	+0·11	+1·74	$\frac{1}{2}$	+·01
12	37·791	32·041	+ 1·59	−2·88	−1·48	1	−·05
13	1·761	35·493	+13·00	+1·03	+1·25	$\frac{2}{3}$	−·05
14	5·276	39·008	+20·90	+0·49	−0·11	$\frac{1}{8}$	−·01

From these normal places and the preliminary elements given above, observation equations were computed by the method of Lehmann-Filhés.* When the eccentricity is very small, experience has shown that it is quite useless to carry through corrections for both ω and T. Moreover, the period was considered determined, and hence equations connecting the values of $\delta\gamma$, δK, δe and $\delta\omega$ with the residuals were computed.

* *A. N.* 3242.

OBSERVATION EQUATIONS ε URSÆ MINORIS.

$\delta\gamma$	δK	$K\delta e$	$K\delta\omega$	V	Weight.	Sum.
1·00	+ ·979	+ ·719	− ·370	− 1·70	½	+ ·628
"	+ ·929	+ ·533	− ·477	− 0·08	⅔	+1·905
"	+ ·777	+ ·037	− ·686	+ 1·49	⅓	+2·618
"	+ ·189	− ·973	− ·990	− 2·83	⅓	−3·604
"	− ·116	− ·941	− ·986	− 1·03	½	−2·073
"	− ·317	− ·718	− ·930	− 2·42	¾	−3·385
"	− ·656	+ ·014	− ·708	− 1·53	½	−1·860
"	− ·756	+ ·303	− ·591	− 0·38	⅔	− ·414
"	− ·926	+ ·906	+ ·219	+ 0·57	1	+1·769
"	− ·615	− ·098	+ ·746	− 0·74	¾	+ ·293
"	− ·050	− ·980	+ ·995	+ 0·11	½	+1·075
"	+ ·338	− ·853	+ ·958	− 2·88	1	−1·437
"	+ ·817	+ ·157	+ ·642	+ 1·03	⅔	+3·646
"	+1·046	+ ·986	+ ·083	+ 0·49	⅛	+3·605

The above observation equations gave the following normals:—

$$
\begin{array}{rrrrrcl}
8{\cdot}292\,x & -\ {\cdot}094\,y & -\ {\cdot}673\,z & -\ {\cdot}328\,u & -6{\cdot}759 & = & 0\\
-\ {\cdot}094\,x & +3{\cdot}781\,y & -\ {\cdot}149\,z & +\ {\cdot}206\,u & +\ {\cdot}118 & = & 0\\
-\ {\cdot}673\,x & -\ {\cdot}149\,y & +3{\cdot}829\,z & -\ {\cdot}239\,u & +5{\cdot}133 & = & 0\\
-\ {\cdot}328\,x & +\ {\cdot}206\,y & -\ {\cdot}239\,z & +4{\cdot}478\,u & +1{\cdot}293 & = & 0
\end{array}
$$

$$
\begin{array}{rcl}
\text{where } x & = & \delta\gamma\\
y & = & \delta K\\
z & = & K\delta e\\
u & = & K\delta\omega
\end{array}
$$

Their solution gives the following values to the corrections:—

$$
\begin{array}{rcl}
\delta\gamma & = & +{\cdot}7022\\
\delta K & = & -\ {\cdot}046\\
\delta e & = & -{\cdot}0387\\
\delta\omega & = & -{\cdot}0094 = -0^{\circ}{\cdot}54
\end{array}
$$

Applying these corrections to the preliminary values above, we obtain the following elements for ε Ursæ Minoris with their probable errors:—

Period, $U=39.482$ days
Eccentricity, $e=0.0113\pm.0103$
Half Amplitude, $K=31.954$ km. $\pm$.330 km.
Longitude of Apse, $\omega=359^{\circ}.46\pm0^{\circ}.55$
Velocity of System, $\gamma=-11.398\pm.224$ km.
Time of Periastron Passage, $T=$J. D. 2,418,005.75
Greatest Pos. Velocity $N_1=+20.918$
" Neg. " $N_2=-42.990$

Projection of Semi-Axis Major $a \sin i=17{,}346{,}000$ km. This solution has resulted in the reduction of Σpv^2 from 20.80 to 9.21 and from this we get the probable error of a normal place of unit weight as ±0.64 km. per second.

The residuals in the table of measures above were obtained by careful scaling from the final velocity curve. The probable error of a plate was computed from these residuals with the following values:—

Probable error average plate,	±1.23 km.
" " three-prism plate,	±1.11 "
" " one- " "	±1.64 "

Considering the quality of most of the plates and the fact that the best of the three-prism plates were made on the coarse-grained 'sigma' emulsion, and with a dispersion of 17.6 and 20.2 Å per millimetre at H_γ these values are as low as could reasonably be expected. Moreover, the three-prism and one-prism probable errors bear about the same relation to one another, as that obtained in the investigation upon the 'Probable Errors of Radial Velocity Determinations' described in last year's report.

Furthermore, an examination of the run of the residuals for the different dispersions gives no indication of any systematic difference in the velocity measures obtained from different spectrographs.

The velocity curve corresponding to the final elements with the positions of the normal places plotted as circles is shown in Fig. 1.

Solar Research.

As is evident from previous reports, the progress made in work with the coelostat telescope and solar spectrograph has not been as good as could be wished. This has been due to a variety of causes, to delay in the completion of the coelostat house and connecting tunnel, to the floor of the laboratory being torn up for the installation of pipes and pump for draining the meridian circle piers, and, after this, to the fact that only an inferior grating could be obtained for use in the spectrograph. The investigation into the properties of this grating is described by Dr. De Lury in Appendix D, and need not be entered into here. The curious focal properties it possesses are not of so much moment as the fact that it gives poor definition and cannot be satisfactorily used for the determination of the solar rotation, the principal problem for which it was planned to use the equipment. Fortunately, we were able to obtain from Prof. Michelson a large plane grating in April of last year, whose properties are also fully described in Appendix D. It will suffice to state that it gives excellent definition and is very bright in the second and third orders on one side, but has considerable astigmatism and gives considerable diffused light, so that the spectrum lines are partially blocked up, the contrast diminished, and the ease and accuracy of their measurement decreased.

When this grating arrived I felt that it was necessary to get the equipment into active and useful work as soon as possible, and, in order to hasten matters, determined to devote a considerable portion of my time to working with Dr. De Lury in the large amount of experimental investigation necessary for determining, first of all, the most advantageous conditions of use of the grating, and secondly, the exacting instrumental precautions necessary in obtaining accurate values of the solar rotation. I was enabled to spend considerable time at this work, because the radial velocity work had become fairly well systematized, the experimental stage had passed, and the observation and measurement had taken on more of a routine character than had been the case heretofore.

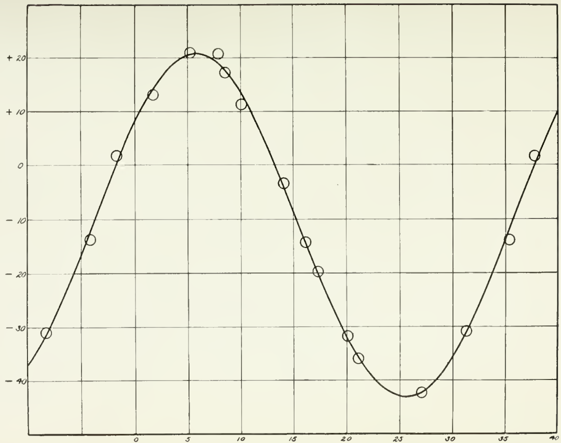


Fig. 1.—Velocity Curve ϵ Ursæ Minoris.

A short account of the various steps taken and experiments conducted during the year may be of interest. The new grating was received about the middle of April, and some visual tests of its focal properties were made by Dr. De Lury. Early in May the photographic testing of its properties began, and it was soon discovered that its astigmatism was due to the lines of the ruling being crooked, so that when about two-fifths of the length of the lines at one end are occulted, the astigmatism entirely disappears. Our diagnosis of the trouble was acknowledged correct by Prof. Michelson when I met him in August. He said the crookedness of the lines was due to the fact that the machine had been mostly used for ruling gratings with lines about 6 cm. long, and that portion of the slide became more worn than the rest. When a line 11 cm. long was ruled, as in this grating, the different conditions at different parts of the slide produced a bend in the line, which caused the diffracted spectrum to be displaced in a direction parallel to the lines, to the amount of about 1 mm. in a focal length of nearly 7000, or about 30 seconds of arc. The superposition of the spectra from these two parts of the ruling gave the astigmatic appearance at the edges of the spectra. The definition given by this grating is excellent, its chief defect seeming to be an excessive amount of diffused light which tends to block up the absorption lines and reduce the ease and accuracy of measurement. Experiments were then undertaken to determine whether diminishing the width of the ruling from either side would help matters, and it was found that successive improvement was noticed as more and more of the ruling at one side was occulted until after 5 cm. was cut off, when no appreciable improvement appeared. Consequently, one corner of the grating was used of an area about 6 by 8 cm. instead of the original area 11 by 13 cm. Nevertheless, owing to the brilliancy of the grating, the exposure times are still comparatively short, about 30 seconds in the third order at the limb of the sun in the region λ 4500. The position of the grating in its holder and on its rotating carriage was changed to bring the used portion centrally within the beam of light coming from the collimator.

Having obtained, after nearly two months' experimenting, the best conditions of use of the grating, our energies were turned towards obtaining spectra for the determination of the solar rotation. The region with centre at λ 4500, and extending on the 12-inch plates used upwards of 100 Å on each side, was selected primarily for observation. This region contains numerous well-defined lines, is well within the range of sensitiveness of the fine-grained Seed process plates proposed to be used with it, and is at a different place from any regions previously investigated.

My experience in stellar radial velocity investigations had shown the necessity of the greatest care being taken in observations of this nature to prevent spurious systematic displacements of the lines, which may arise from a large number of causes. In stellar spectroscopy we have found that relative displacements of stellar and comparison lines may arise from temperature changes, from flexure of the spectrograph, from faulty guiding resulting in the star image not being on the whole symmetrically situated with respect to the slit, from non-uniform illumination of the objectives and prisms by star or spark light, from imperfect focussing of the camera and probably from other causes as well. It was very important, therefore, in the case of the solar rotation where the Doppler displacements are relatively small, to ensure that no spurious displacements occurred. The first rotation plates made were consequently more in the nature of trial plates than for actual determinations, and were made only at the solar equator where the displacement is greatest and approximately known.

Numerous experimental rotation plates were made during June and July, and a number of these were measured. The general tendency of the measures gave a rather lower value of the velocity than had previously been accepted. It may be mentioned that one observer, Halm, claims to have found a variation in the rate

of rotation, obtaining rotational values lower than given by these plates. However, owing to the fact that our plates were experimental and taken under conditions inferior to those with which later plates were made, they are not put forward as giving any definite value of the rotation, but simply as examples of the method and to indicate the magnitude of the errors and variations to be expected. The detailed measures of some of them are given below.

It was soon found that the principal difficulty consisted in obtaining uniform illumination of the grating surface from the two opposite limbs. The light from opposite limbs is brought simultaneously to positions side by side on the slit by two pairs of reflecting prisms. This device was designed by myself, constructed by the J. A. Brashear Co., and has been described by De Lury in the report of 1908–9, p. 252. Dr. De Lury inserted screws through the top of the prism holders to enable them to be adjusted for uniform illumination of the grating surface, but these were found insufficient for the exact adjustment necessary. Moreover, owing to the narrowness of the small windows in the guide plate (1908–9 report, p. 253) which admit light to the prisms and which are only slightly over a millimetre wide, the width of the image on the grating is further limited, rendering more precise adjustment necessary than would otherwise be the case. A further difficulty is experienced in the adjustment of the three prisms above the slit, two at the east and one at the west, to enable a strip of spectrum from the east limb to be placed centrally between two strips from the west limb. It was felt necessary to change the design in some way to admit of more positive and exact adjustment of these prisms, and to avoid the limiting of the illumination produced by the narrow windows above mentioned. This was postponed until after my return from the meeting of the Solar Union, although the general nature of the improvements had been thought out previously. They consisted essentially in mounting the prisms in small carriages adjustable in every direction, in obtaining new prisms to replace the three used over the slit, a single one at the west for the east limb and a wider notched one at the east for the west limb, in the substitution of an improved guide plate and in focussing the solar image on the slit instead of the guide plate which, taking account of the length of path traversed by the light, is optically about 14 cm. in front of the slit. In order to make the changes more readily understood the new arrangement on the front of the spectrograph will be described later.

Owing to the co-operative arrangement entered into at the Solar Union, details of which are fully described under the heading of 'Committee Work,' the region to be observed at Ottawa is from $\lambda\,5500-\lambda\,5700$ and the general region near $\lambda\,4250$. Consequently, upon my return in September, further experimental work on the plates and developers most suitable for these parts of the spectrum had to be undertaken. The plates used at $\lambda\,4500$ had been the regular Seed Process plates which have a fine grain and are clean-working. The contrast in the resulting spectra was not as great as it should be, and, although this was ascribed mostly to the diffused light given by the grating, it was thought that a change of developer or plate might help matters. No material improvement resulted from change of developer although several different contrast formulæ were tried. I learned, however, that the Seed Co. made a Contrast Process plate which, on trial, gave much more vigorous results than the other, and hence more suitable for the measurement of spectrum lines. This plate answers admirably for the violet region at $\lambda\,4250$, but is, of course, not sensitive to the yellow green at $\lambda\,5600$.

I sensitized some of these Contrast Process plates by bathing in a solution of erythrosine. These, upon testing, were fairly suitable, although the sensitiveness began to diminish to the red side of $\lambda\,5600$, but, owing to the troublesome nature of the staining and drying process and to the poor keeping qualities of the bathed plates, it was felt that commercially orthochromatized plates with fine-grained emulsion would be more convenient and satisfactory. Unfortunately the Seed Dry

Plate Co. do not make Ortho Process plates. A trial of the Wellington and Cramer Orthochromatic Process emulsions, which were available, resulted in favour of the Cramer as giving more contrast and being somewhat finer in grain, but it is decidedly coarser than the Seed Contrast, and consequently will not give quite as satisfactory plates for measurement in the λ 5600 region as the Seed Contrast Process does in the λ 4250 region. However, its better keeping qualities and more uniform sensitiveness in the required region over the bathed plate more than outweighed the relative coarseness of grain, and it was chosen for use at λ 5600.

It was while these experiments were being carried on that a new grating, which had been most generously offered to us by Prof. Michelson, was received. A very exhaustive test of this grating in comparison with the one in use was carried out, and, without going into details, it was decided to keep the original grating because of its superior brightness and its finer ruling with correspondingly greater dispersion. By this time the improvements in the reflecting prism attachment and the new guide plate had been completed, and further test rotation plates were made from time to time, measures of some of which are also given below. The conditions during the winter months were, however, so inferior to those in warmer weather, especially in regard to the solar definition and the short time available for exposure during the day, that no attempt was made to get any definitive series of rotation plates. Considerable time was spent, however, in obtaining plates in the region around λ 4250 having impressed upon them an arbitrary displacement of the spectral lines of the same order as the Doppler displacement, only produced by a special slit in such a way that it was bound to be the same for each line on a plate and for successive plates. The purpose was to determine personal errors in measurement for different lines. This investigation is, however, fully discussed by Dr. De Lury in Appendix D, and need not be further referred to here except to say that measurements were made by each of us of 12 spectra from which some interesting conclusions were drawn.

Although the work of the year has not resulted in any definitive values of the solar rotation, there has nevertheless been a great deal of preliminary experimental work done which has been necessary to learn the best conditions of use of the grating, the best plate and developer, the indispensable instrumental and other precautions required for accurate work, and many other details. The measurement of the plates secured has also enabled us to learn something concerning the most suitable optical system and magnification to be used and the personal and systematic errors to be expected. We are now ready to secure a definitive series of rotation plates which will be made as soon as the weather becomes more suitable.

Before giving the measures of the trial plates made during the year, it will be desirable to give a short description of the slit end of the spectrograph, which has been considerably altered during the year.

In designing the new apparatus it was deemed essential to avoid the limiting of the pencil incident upon the prisms by the narrow openings in the old guide plate, which had cut off some of the marginal pencils. Indeed, as they were only slightly over a millimetre wide, as the optical path between them and the slit was between 13 and 14 cm. and the focal length of the collimator objective about 700 cm., 23 feet, it is evident that the width of the pencil transmitted through them on the collimator and grating, omitting diffractional spreading, will be $\frac{1}{135} \times 700 = 5.2$ cm. The actual width of the used surface of the grating is 8 cm. The inclination of the grating reduces this somewhat, so that the projected width is in the neighbourhood of 7 cm. If the pencil from the mirror, which is 18 inches diameter and 80-foot focus, goes through unobstructed, the diamcter of the beam on the grating will be $\frac{23}{80} \times 18 = 5.2$ inches, or 13 cm. This diameter would require a width of window in the guide plate approximately 2.5 mm. Such a size of opening would render the effective position of the point on the sun's image from which the light was taken,

consequently the latitude and distance from the limb, uncertain. It was consequently felt preferable, which opinion was confirmed by learning the experience of other observers at the Solar Union meeting, to avoid limiting the pencil at the prisms but to focus the sun's image on a point as far behind the prisms as the distance of the optical path between its first incidence on the prisms and the slit—in other words, to bring the focus on the slit itself. Then the area on the sun's surface from which the light is taken is limited to the length and width of the slit and there is no diaphragming of the pencils; hence the diameter of the beam incident upon the collimator objective and grating is 13 cm., a factor of safety of nearly two. The distance from the limb at which the light is taken is determined by measuring the distance apart of two wires or strips placed in front of the outside prisms which cast shadows centrally on the circles of light thrown on the grating. This distance has to be increased slightly, by an amount readily calculated, owing to the distance of the wires optically in front of the slit and the consequent speading of their shadows at the slit.

A diagrammatic representation of the reflecting prism arrangement is shown in Fig. 2, where A and B are the prisms receiving light from the west and east limbs of the sun respectively, and C and D the prisms above the slit which reflect the light down through the slit in the manner shown. As stated before, the centre prisms were replaced by new ones last fall. Formerly the function of C was fulfilled by two prisms similar to D which were considerably more difficult to adjust, and a single prism with a notch cut in it, as shown, was substituted. The two pencils from the west limb passing through the slit are then bound to produce coincident circles of illumination on the collimator objective. The method of adjusting these prisms is clearly shown by the plan and elevations. Each prism is mounted in a small brass box and adjusted laterally in these boxes by the adjusting screws, E, E, at the one side. A spring at the opposite side keeps constant pressure against the adjusting screws, while a spring at the top keeps them seated on a piece of blotting paper at the bottom. The adjustment of the boxes is effected in the one plane by rocking on the knife edges, F, F, shown in the upper elevation, by means of the screws, H, H, and in the plane perpendicular to this by the adjusting screws, I, I, and opposing springs, S, S, shown in the lower elevation. The plates on which the adjustable holders of the outer prisms are fastened are movable in and out by rack and pinion to vary the distance from the limb at which the light is taken, and the plate on which the holders of the two centre prisms are fastened is also movable by rack and pinion to enable the centre strip, the one from the east limb, to be made wider or narrower, the width of the outer strips being changed by occulting plates sliding in grooves just below the prism. However, it was soon decided to make all three spectra of the same width, about 0.8 mm., separated by spaces about 0.5 mm. to ensure absolutely uniform conditions for measurement. This was effected by removing the occulting plates just mentioned and inserting a single plate with three slots 0.8 mm. wide cut in it, these slots being separated by spaces of 0.5 mm. This not only ensures absolute uniformity, but prevents any stray light reflected from the edges of the prisms from causing trouble. The arrangement has been found to answer admirably, not only in the uniformity of the spectra produced and in ease of adjustment, but also the placing of the narrow strip from one limb exactly midway between two strips of the same width from the other limb, ensures ease and accuracy of measurement, as the measured displacement has no dependence on the orientation of the wire.

This prism arrangement projects about 5 cm. in front of the front plate of the spectrograph, and is covered and protected from dust and injury by the guide plate shown in Fig. 3. This guide plate consists, in reality, of two plates. The first is a rectangular brass plate, A, A, about 2 mm. thick, which is rigidly attached to four

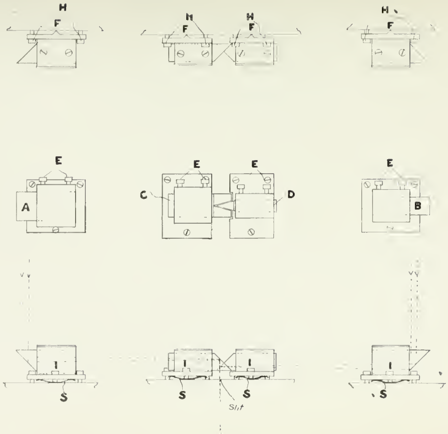


Fig. 2.—Reflecting Prism Arrangement.

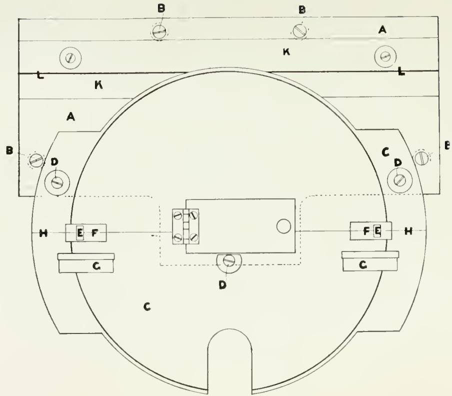


Fig. 3.—Guide Plate.

brass studs 5.5 cm. long, screwed into the front plate of the spectrograph by means of the screws, B, B. Dowel-pins in two of these studs ensure that if the plate is taken off it will return to exactly the same position. The second is a plate, C, C, of circular form attached to the base plate by three screws, D, D. The holes through the plate are considerably larger than the screws, allowing movement under the washers shown and final clamping when the adjustment is completed. A door in the centre admits of adjusting the centre prisms and changing the width of the slit without removing the whole plate. Light is admitted to the outer prisms through two openings, E, E, in small rectangular brass plates sliding in ways underneath the plate, C, C. The large opening, F, F, cut in C, C, being sufficiently long to allow the light to be taken at any distance from the limb up to nearly one-third the radius. The openings, E, E, are about 4 × 6 mm., sufficiently wide to avoid any danger of limiting the pencil, and yet small enough to prevent much dust getting into the prisms. A further protection is given by the yellow filters used in the λ 5600 region to absorb the violet of higher orders, which are placed in the brass receptacles, G, G.

For the purposes of adjustment, the centre line, H, H, and the dark circle 228 mm. diameter, the mean size of the solar image, near the periphery of the outer plate are ruled on the brass. The outer prisms and the openings, E, E, are adjusted until they are the desired distance from the limb and equidistant from this dark circle, from the centre of the plate and the slit. The actual positions at which the light enters these prisms is obtained by sliding a vertical wire or narrow tongue of brass, less than a millimetre wide, in front of E, E, and observing the shadow cast on the circle of illumination on the collimator and grating through an opening in the camera back behind the slot, I, which is placed there to allow the use of an eyepiece. Then, by using a horizontal occulting strip, the centre line, H, H, is adjusted, by loosening the screws, D, D, to be directly over the centre of the points where light enters the prisms. Hence we are sure, if the sun's image is kept concentric with the circle, that light is being taken from two points, on a diameter of the sun, equidistant from the limb. For convenience in obtaining the east and west line, a plate of thin celluloid, K, K, on which is ruled a black line, L, L, is adjustably attached to the base plate, the line, L, L, being made accurately parallel to H, H.

It is evident, when these adjustments have been made, that the observed reading of the graduated circle on the end of the spectrograph, when the limb of the sun drifting across the guide plate remains tangent to L, L, corresponds to the position where the light entering the slit comes from a diameter of the sun due east and west. If the spectrograph be rotated by the amount given in the ephemeris as the position angle of the sun's axis, it is evident that the observed points on the solar disc are at right angles to the axis and along a diameter and, if the pole of the sun is in the limb, are on the solar equator. All that is now necessary to make a rotation plate for any latitude is to rotate the spectrograph through the required position angle and keep the sun guided centrally on the guide plate during the exposure.

MEASURES OF PLATES.

Of the numerous test plates made during the year, practically all at the solar equator, a number were selected for measuring, the selection being made on the basis of the most suitable intensity for measurement of a number from each series, and the measures of 20 of these are given below. As will have been gathered from what has been given previously, each exposure contains three narrow strips of spectrum each about 0.8 mm. wide separated by strips of clear glass about 0.5 mm. wide, the central strip of spectrum being from the east limb and the two outer strips from the west limb of the sun. As the sun is rotating so that the east limb approaches

and the west limb recedes from us with a velocity of about 2 km. per second at the equator, it is evident that the lines in the centre strip will be displaced towards the violet with respect to those on the outside strips. This displacement, with the dispersion used here, varies between 55 and 90 thousandths of a millimetre according to the region used and the order of the spectrum.

In making measures of these plates, all that requires to be measured is the magnitude of this displacement, a differential measurement only, and consequently as the lines in the strips are, or should be, exactly similar in appearance, one in which apparently there should not be much danger of personal or systematic errors. However, we had not gone very far before we began to suspect the presence of such errors and one attempt to investigate this problem is given by Dr. De Lury in Appendix D. But the last word has not yet been said on this question, and I have no doubt that it will recur later.

The measurements were all made on the special Toepfer measuring machine obtained some time ago for this work, which has not hitherto been described. The principle of its action is similar to that in the machine used for measuring star spectra, by the same maker, and already described in my report of 1905–6, page 62, the optical parts being exactly the same. The plate is placed on a carriage, moved by means of a micrometer screw of 0.5 mm. pitch and of a usable length of 300 mm. Thus the whole length of the plates made in the solar spectrograph can be measured without changing their position on the carriage. It consists essentially, as can be seen by the photograph (Fig. 4), of a massive cast-iron base having, at the front, ways on which the microscope carriage slides. The turning of a clamping lever allows this carriage to be pushed along these ways to any position, indicated by a millimetre scale. This movement not only permits the microscope to be at once brought to any desired position on the plate, without moving the main carriage, by means of the micrometer screw, which might be a rather slow process as there are over 600 turns in its length, but also allows the plate to be rapidly aligned on the carriage, as the ways on which the microscope slides are adjustable and can readily be made exactly parallel with the ways on which the carriage moves. The micrometer carriage itself, which is inclined at an angle of about 45°, rests on its lower edge on a pair of steel balls about a centimetre in diameter, which are maintained at a fixed distance apart in the ways. The latter consist of a V-shaped groove in the base and in the carriage which hence moves by rolling friction very easily and smoothly. At the centre of the upper edge of the carriage a small wheel is pivoted which rolls along a plane surface on the base. Hence the movement of the carriage is practically frictionless and it is easily kept up to its work by a comparatively small weight which maintains a small constant uniform thrust on the micrometer screw. A hardened small spherical surface on the end of the micrometer screw resting against a hardened steel plate takes up this thrust, and by this means all back lash is prevented and the screw and the carriage work exceptionally freely and smoothly, especially when the comparatively large mass of the latter is considered. On the main carriage are also secondary ways parallel to the main ways which permit the plate to be adjusted to any desired position by a small micrometer screw. This secondary carriage has also a movement of rotation to allow the alignment of the spectrum parallel to the motion of the carriage, this being effected by a thrust screw and spring. The spectrum plate rests on a piece of plate-glass in the carriage, being held there by spring clips and capable of transverse adjustment.

The micrometer head, movable by a handle for long runs or by a large or small knurled head for fine adjustment, is divided into 500 parts. As the screw is 0.5 mm. pitch, it reads directly to microns and by estimation to tenths of microns or 0.0001 mm. Two rows of numbering on the head facilitate the reading of the

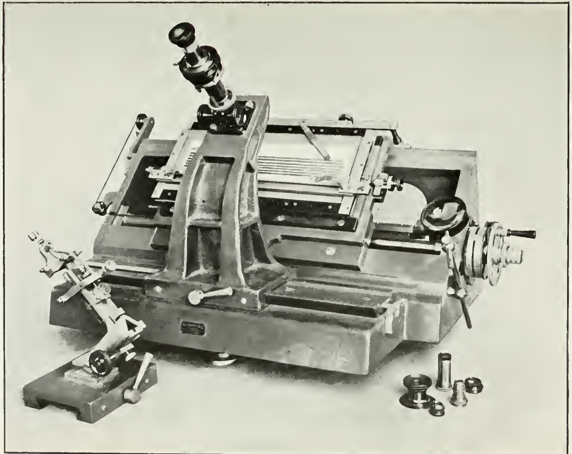


Fig. 4.—Toepfer Measuring Machine.

divisions, while a second auxiliary head beside the principal one, geared at the proper rate enables single millimetres to be determined at the same time. Divisions of ten millimetres are given on a scale beside the carriage. An adjustable magnifying glass over the head enables the readings to be made without shifting the position of the eyes to any extent.

The microscope is provided with objective and ocular giving any range of magnification between 2 and 100, and is focussed by rack and pinion. The reticle has two parallel wires which can be made to coincide or can be separated any desired distance and can be given any desired position angle. By rotating a knurled ring on the microscope head, a pair of shade glasses limit the field to any desired width perpendicular to the wires.

The instrument is a magnificent piece of workmanship and performs very satisfactorily. The only improvements that suggest themselves are a registering attachment and a means of more rapidly rotating the screw when long distances are to be moved over. The former has been applied to a later machine of the same design made for the Astrophysical Observatory at Potsdam and must add considerably to its usefulness. Although no tests of the accuracy of the screw have been made, yet if we may judge from the tests of similar screws by the same makers it is of very high accuracy. In the manner of measuring the small differential displacements in rotation work, any errors of even comparatively great amount would be compensated, and consequently no investigation of the screw has yet been undertaken.

The method of measuring these plates is practically the same as that followed with star spectra. After the plate is placed on the carriage and adjusted, a matter of a minute or so, the first line to be measured is brought under the wire. Four settings are made on the centre strip and two each on upper and lower strips. As the appearance of the lines is practically identical, there seems little chance for the personal error found when measuring both emission and absorption lines in star spectra. In order to avoid any possibility of this, however, after all the lines have been measured the plate is reversed on the carriage and remeasured. Even if there is no systematic difference between the measurements, one sees the lines differently and the measurement is for this reason, and for the added number of settings, more accurate.

The reduction of the measured displacements is quite simple. Although the spectra given by this form of spectrograph are not normal, the deviation from a linear relation of micrometer value and wave lengths is so small as to be inappreciable in the range of about 200 Å on a plate. Consequently the only thing necessary is to obtain at say half a dozen places on the plate the linear dispersion by dividing the distance between two lines by the difference in wave length. Obtaining in the well-known way the kilometre value of one millimetre at these regions and plotting them on cross-section paper with wave length as abscissa and velocities as ordinates, these values are found to lie, within the errors of measurement, on a straight line. Consequently the velocity value of a millimetre displacement at all the lines measured can be at once tabulated and we get the constant multipliers of the displacements, giving the velocities.

In the region centre at λ 4500, 29 lines were measured and in the last 5 plates at λ 5600 from 16 to 18 lines. These lines were selected to include as many elements as possible and for their quality for measurement. The wave length, element, intensity and kilometre constant are given in the following table. The value of the velocity in kilometres per second for a displacement of one millimetre on the plate is

in these tables divided by two, so that the double displacement due to the spectrum lines from the east limb being displaced to the violet and from the west limb an equal amount to the red is reduced to the velocities of one limb with respect to the centre.

After the table of wave lengths are given the measures of the 20 plates selected. At the head of this table are given the plate number and the date in eastern standard time. In the first column are the wave lengths of the different lines measured followed by, in parallel columns, the displacement in ten thousandths of millimetres and the velocity in kilometres. At the foot of the columns are given the mean velocities for the plates and the probable error of measurement of a single line obtained from the residuals in the well-known way.

DATA OF LINES MEASURED

Wave Length.	Elt.	Int.	Vel. per mm. II Order.	Vel. per mm. III Order.	Wave Length.	Elt.	Int.	Vel. per mm.
4432·736	*Fe*	1	33·08	20·64	5506·095	*Mn*	1	25·888
4435·321	*Fe*	2	33·05	20·62	5507·000	*Fe*	7	25·881
4438·510	*Fe*	1	33·03	20·60	5525·765	*Fe*	4	25·763
4445·641	*Fe*	1	32·97	20·55	5528·641	*Mg*	8	25·742
4454·552	*Fe*	3	32·88	20·49	5544·157	*Fe*	2	25·650
4464·617	*Ti?*	2	32·76	20·39	5562·933	*Fe*	2	25·531
4468·663	*Ti*	5	32·76	20·39	5576·320	*Fe*	4	25·450
4484·392	*Fe*	4	32·61	20·28	5578·946	*Ni*	1	25·434
4489·911	*Fe*	4	32·57	20·25	5582·198	*Ca*	4	25·413
4502·388	*Mn*	2	32·46	20·15	5590·343	*Ca*	3	25·363
4508·455	*Fe?*	4	32·40	20·11	5618·858	*Fe*	1	25·186
4512·906	*Ti*	3	32·38	20·08	5634·171	*Fe*	3	25·090
4518·198	*Ti*	3	32·34	20·04	5638·488	*Fe*	3	25·063
4523·572	*Mn?*	1	32·28	20·01	5655·715	*Fe*	2	24·956
4527·101	*Ca?*	1	32·24	19·98	5658·097	......	2	24·936
4531·801	*Fe*	2	32·20	19·94	5662·744	*Fe*	4	24·912
4534·953	*Ti*	4	32·18	19·92	5682·869	*Na*	5	24·790
4546·129	*Ca*	3	32·07	19·84	5688·436	*Na*	6	24·757
4548·938	*Ti*	2	32·06	19·83	....	......	......	....
4564·211	*Ba*	8	32·00	19·78	....	......	......	....
4555·662	*Ti*	3	31·99	19·77	....	......	......	....
4558·827	*C?*	3	31·97	19·75	....	......	......	....
4563·939	*Ti*	4	31·92	19·71	....	......	......	....
4571·275	*Mg*	5	31·86	19·66	....	......	......	....
4572·156	*Ti*	6	31·85	19·65	....	......	......	....
4578·732	*Ca*	3	31·80	19·61	....	......	......	....
4590·126	*?*	3	31·70	19·53	....	......	......	....
4602·183	*Fe*	3	31·60	19·45	....	......	......	....
4603·126	*Fe*	6	31·58	19·44	....	......	......	....

MEASURES OF ROTATION PLATES.

Line.	493a		493b.		497a.		527a.		527b.	
	June 21, 11.00		June 21, 11·00		June 21, 12·00		June 30, 10·30		June 30, 10·30	
	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.	Disp.	
4432·736	·0539	1·783	·0586	1·938	·0867	1·790	·0531	1·756	·0536	1·773
4435·321	541	1·788	550	1·818	921	1·899	529	1·748	537	1·774
4438·570	548	1·810	531	1·754	891	1·835	532	1·757	550	1·816
4445·641	....	....	581	1·915	913	1·876	528	1·741	541	1·783
4454·552	541	1·779	546	1·795	837	1·716	544	1·788	539	1·773
4464·617	530	1·738	546	1·790	850	1·736	530	1·739	538	1·765
4468·663	548	1·795	577	1·890	909	1·853	524	1·717	535	1·753
4484·392	539	1·758	540	1·761	836	1·695	540	1·761	537	1·752
4489·911	543	1·768	565	1·840	879	1·779	524	1·707	548	1·784
4502·388	542	1·759	551	1·788	888	1·790	547	1·776	541	1·756
4508·455	555	1·798	533	1·727	893	1·795	552	1·788	561	1·817
4512·906	550	1·781	596	1·930	876	1·759	558	1·806	559	1·810
4518·198	545	1·762	533	1·723	904	1·811	540	1·745	543	1·755
4523·572	554	1·788	531	1·714	957	1·915	558	1·801	563	1·817
4527·101	556	1·793	557	1·796	913	1·824	561	1·808	554	1·786
4531·801	541	1·742	563	1·812	930	1·855	557	1·794	552	1·777
4534·903	550	1·769	541	1·741	885	1·763	554	1·783	553	1·780
4546·129	545	1·748	535	1·716	905	1·795	550	1·764	554	1·776
4548·938	544	1·744	546	1·750	836	1·658	555	1·779	553	1·772
4554·211	549	1·757	580	1·856	880	1·740	554	1·773	552	1·767
4555·662	555	1·774	592	1·894	934	1·846	543	1·738	555	1·775
4558·827	555	1·776	598	1·912	893	1·764	561	1·793	554	1·772
4563·939	563	1·797	552	1·761	870	1·715	562	1·793	546	1·743
4571·275	546	1·740	570	1·815	887	1·743	561	1·787	551	1·755
4572·156	560	1·783	539	1·717	887	1·743	544	1·733	560	1·783
4578·732	574	1·825	614	1·952	968	1·898	564	1·793	578	1·837
4590·126	559	1·772	580	1·838	824	1·609	563	1·785	549	1·740
4602·183	575	1·817	569	1·798	949	1·845	576	1·820	562	1·776
4603·126	566	1·787	544	1·718	919	1·786	561	1·772	581	1·835
Means	....	1·776	....	1·809	....	1·787	....	1·770	....	1·780
Probable Error, Single Line	....	± ·015	....	± ·050	....	± ·018	....	± ·019	....	± ·014

MEASURES OF ROTATION PLATES—(*Continued*).

Line.	528a.		531a.		531b.		550a.		553d.	
	July 5, 10·35		July 5, 2·50		July 5, 2·50		July 13, 10·30		July 13, 11·20	
	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.
4432·736........	·0569	1·882	·0570	1·885	·0573	1·895	·0538	1·780	·0549	1·816
4435·321........	559	1·848	572	1·890	574	1·897	541	1·788	556	1·837
4438·570........	569	1·880	573	1·892	570	1·882	556	1·836	534	1·764
4445·641........	562	1·852	559	1·843	567	1·869	542	1·786	535	1·763
4454·617........	557	1·832	565	1·858	563	1·852	565	1·857	548	1·802
4464·617........	571	1·873	575	1·886	577	1·892	535	1·755	529	1·735
4468·663........	571	1·870	564	1·848	573	1·877	562	1·841	554	1·814
4484·392........	578	1·882	570	1·858	566	1·846	548	1·787	561	1·829
4489·911........	581	1·892	570	1·857	572	1·863	555	1·807	550	1·790
4502·388........	580	1·882	576	1·869	575	1·866	556	1·805	551	1·788
4508·455........	588	1·905	571	1·850	574	1·860	559	1·811	550	1·782
4512·908........	570	1·846	569	1·843	584	1·891	540	1·749	560	1·813
4518·198........	585	1·890	580	1·874	586	1·894	558	1·803	558	1·804
4523·572........	585	1·888	597	1·926	587	1·894	547	1·765	553	1·785
4527·101........	571	1·841	584	1·883	584	1·879	558	1·800	550	1·777
4531·801........	573	1·845	583	1·877	581	1·871	556	1·790	553	1·780
4534·903........	580	1·866	592	1·905	584	1·879	548	1·764	557	1·792
4546·129........	579	1·857	579	1·857	571	1·832	560	1·796	562	1·802
4548·938........	585	1·875	591	1·894	590	1·891	569	1·824	555	1·779
4554·211........	576	1·843	582	1·862	591	1·891	572	1·830	565	1·808
4555·662........	574	1·837	582	1·862	586	1·875	558	1·786	563	1·801
4558·827........	589	1·883	579	1·851	576	1·841	555	1·775	554	1·772
4563·939........	587	1·873	585	1·867	575	1·835	572	1·825	571	1·822
4571·275........	586	1·867	585	1·864	575	1·832	557	1·775	560	1·784
4572·156........	589	1·875	587	1·869	594	1·892	574	1·828	571	1·818
4578·732........	578	1·838	586	1·863	591	1·879	559	1·778	555	1·765
4590·126........	577	1·829	576	1·826	597	1·892	580	1·838	564	1·787
4602·183........	597	1·886	589	1·861	593	1·874	560	1·770	563	1·779
4603·126........	593	1·873	579	1·829	582	1·839	571	1·803	571	1·803
Means........	....	1·866	....	1·868	....	1·872	....	1·798	....	1·793
Probable Error, Single Line.	....	± ·014	......	± ·015	....	± ·015	.....	± ·019	....	± ·015

MEASURES OF ROTATION PLATES—(*Continued*).

Line.	558a.		566a.		566b.		570a.		577d.	
	July 14, 9·55		July 16, 11·10		July 16, 11·12		July 18, 11·00		July 25, 9·55	
	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.
4432·735........	·0551	1·822	·0556	1·839	·0573	1·893	·0551	1·822	·0550	1·841
4435·321........	555	1·854	557	1·840	555	1·834	546	1·805	563	1·884
4438·370........	548	1·810	552	1·823	563	1·859	550	1·816	545	1·818
4445·641........	548	1·806	548	1·807	557	1·836	563	1·855	553	1·838
4454·552........	551	1·811	543	1·786	556	1·829	559	1·839	559	1·856
4464·617........	554	1·817	562	1·843	553	1·814	554	1·801	545	1·807
4468·663........	561	1·837	564	1·847	567	1·857	557	1·814	553	1·828
4484·392........	557	1·816	568	1·852	570	1·858	566	1·817	558	1·839
4489·911........	557	1·814	553	1·801	565	1·841	562	1·843	557	1·832
4502·388........	549	1·782	554	1·798	553	1·795	553	1·824	571	1·870
4508·455........	561	1·818	568	1·841	566	1·834	568	1·792	564	1·839
4512·906........	556	1·800	573	1·855	560	1·813	564	1·839	559	1·821
4518·198........	561	1·813	566	1·830	572	1·849	572	1·823	571	1·850
4523·572........	560	1·807	576	1·858	572	1·846	557	1·846	572	1·849
4527·101........	560	1·806	565	1·822	569	1·835	561	1·796	580	1·870
4531·801........	559	1·800	561	1·806	558	1·796	567	1·806	561	1·809
4534·903........	557	1·793	580	1·866	572	1·840	562	1·824	559	1·799
4546·129........	568	1·821	575	1·844	571	1·832	571	1·803	564	1·809
4548·938........	566	1·815	564	1·808	574	1·840	563	1·830	564	1·808
4554·211........	565	1·808	572	1·850	577	1·846	571	1·802	567	1·815
4555·662........	569	1·820	571	1·827	569	1·821	553	1·824	573	1·833
4558·827........	574	1·835	576	1·841	572	1·829	566	1·768	568	1·810
4563·939........	579	1·848	567	1·810	577	1·841	577	1·807	571	1·818
4571·275........	573	1·825	572	1·822	570	1·816	570	1·838	572	1·819
4572·156........	575	1·831	573	1·825	578	1·840	575	1·815	576	1·826
4578·732........	570	1·813	575	1·829	570	1·812	570	1·828	575	1·817
4590·126........	576	1·826	580	1·838	574	1·819	565	1·791	587	1·849
4602·183........	575	1·817	564	1·792	579	1·829	562	1·776	575	1·806
4603·126........	578	1·826	576	1·820	571	1·804	571	1·803	586	1·839
Means..........	....	1·816	....	1·828	....	1·834	....	1·816	....	1·831
Probable Error, Single Line..	....	±·009	....	±·013	....	±·015	....	±·014	....	±·014

MEASURES OF ROTATION PLATES.—*Concluded.*

Line.	600c.		601d.		609a.		610a.		610d.	
	Nov. 9, 3·20.		Nov. 9, 3·37.		Dec. 6, 2·00.		Dec. 6, 2·55.		Dec. 6, 3·00.	
	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.	Disp.	Vel.
5506·095........	·0693	1·794	·0672	1·740	·0696	1·802	·0660	1·708	·0684	1·771
5507·000........	659	1·706	670	1·734	689	1·788	673	1·742	672	1·739
5525·765........	691	1·780	715	1·842	713	1·856	697	1·795	707	1·821
5528·641........	685	1·763	690	1·776	688	1·771	690	1·776	707	1·820
5544·157........	702	1·787	696	1·772	709	1·819	717	1·839	706	1·811
5562·933........	692	1·760	708	1·799	683	1·744	690	1·762	707	1·804
5576·320........	701	1·781	708	1·796	715	1·819	686	1·745	695	1·769
5578·946........	688	1·745	708	1·792	700	1·780	674	1·715	690	1·755
5582·198........	682	1·726	713	1·787	708	1·799	711	1·807	689	1·748
5590·343........	703	1·762	725	1·810	709	1·797	685	1·737	680	1·724
5618·858........	705	1·759	719	1·793	724	1·824	665	1·675	721	1·815
5634·171........	692	1·726	715	1·781	723	1·814	716	1·796	722	1·812
5638·488........	686	1·709	724	1·798	718	1·799	689	1·726	730	1·829
5655·715........	702	1·743	707	1·780	721	1·799	677	1·689	736	1·836
5658·097........	704	1·745	677	1·730	708	1·766	695	1·733	722	1·800
5662·744........	698	1·730	708	1·780	735	1·830	713	1·776	707	1·761
5682·869........	....	....	....	....	737	1·831	719	1·782	714	1·770
5688·436........	....	....	....	....	718	1·778	694	1·718	717	1·775
Means........	....	1·752	....	1·786	....	1·800	....	1·751	....	1·787
Probable Error, Single Line...	....	± ·018	....	± ·020	....	± ·017	....	± ·029	....	± ·023

Having obtained the measured values of the velocity, three corrections require to be applied. In the first place, the observation must be made at a certain distance within the limb, and the first correction is to reduce this measured velocity to that at the limb. This is effected by multiplying the velocity by the ratio of the solar radius to the radius or distance from the centre of the observed point. In the second place, owing to the fact that the equator of the sun and the ecliptic are inclined about 7°15′ to one another the direction of the measured velocity does not coincide with the actual velocity, and requires to be multiplied by the secant of the angle of inclination. This angle can be readily computed but is most conveniently obtained from tables prepared by Dunér*. These two corrections give the velocity relative to the earth or the synodic value of the rotation. Owing to the movement of the earth around the sun, the sidereal rate of the solar rotation is appreciably greater. Tables of this correction have also been computed by Dunér† and have been used here. The corrected values of the velocity are given in the following table with the probable error of the final mean velocity and of a single plate.

* Dunér· "Über die Rotation der Sonne, zweite Abhandlungen", Nova Acta Regiae Societatis Scientiarum Upsaliensis, Series 4, I, No. 6, 1906.
† Ibid.

SUMMARY OF ROTATION VALUES.

Plate.	Measured Velocity.	Probable Error, Single Line.	Correction to Limb.	Correction for Inclination.	Sidereal Correction.	Total Velocity.
493a	1·776	± ·015	+ ·040	+ ·001	+ ·133	1·950
493b	1·809	·050	·041	·001	·133	1·984
497a	1·787	·018	·041	·001	·133	1·962
527a	1·770	·019	·044	·002	·133	1·949
527b	1·780	·014	·045	·002	·133	1·960
528a	1·866	·014	·050	·003	·133	2·052
531a	1·868	·015	·050	·003	·133	2·054
531b	1·872	·015	·050	·003	·133	2·058
550a	1·798	·019	·128	·005	·133	2·064
553d	1·793	·015	·127	·005	·133	2·058
558a	1·816	·009	·049	·005	·133	2·003
566a	1·828	·013	·047	·006	·133	2·014
566b	1·834	·015	·046	·006	·133	2·019
570a	1·816	·014	·050	·006	·133	2·005
577d	1·831	·014	·047	·008	·133	2·019
600c	1·752	·018	·092	·003	·140	1·987
601d	1·786	·020	·094	·003	·140	2·023
609a	1·800	·017	·105	·000	·141	2·046
610a	1·751	·029	·099	·000	·141	1·991
610d	1·787	·023	·102	·000	·141	2·030

Mean value of velocity = 2·011 ± ·0056km.
Probable error, single plate = ± ·026km.

Only a few words need be said in discussion of these results. The mean value, 2.01 km., is about 2 per cent. lower than the accepted value. Owing, however, to the preliminary character of the observation, not much importance should be attached to such a difference which is, after all, comparatively small and which may possibly be instrumental or may even be due to personal habits of measurement. While at Mt. Wilson last summer, Miss Lasby, who has measured most of Adams' plates, and myself measured a number of these displacements on both the Mt. Wilson and Ottawa plates. My measures were consistently approximately 2 per cent. lower than hers, an amount sufficient to explain the discrepancy. Again, the instrumental conditions under which the majority of these plates were obtained were not entirely satisfactory, principally on account of inadequate means of adjusting the reflecting prisms and the limiting of the pencil by the narrow windows. The velocities of the different plates show moderately good agreement, the probable error of a single plate being ± .026 km., and of the mean of all the plates ± .0056 km. The probable error of measurement of a single line is on the average ± .018, while the probable error of a single plate determined from the internal error of measurement is little more than ± .003 km., about one-eighth of that obtained by comparing different plates. This ratio is rather greater than it should be, but even Adams' values show a ratio which, though not so great, is still of the same order. Our experience in radial velocity measurements shows us that instrumental errors causing relative displacements of the lines as a whole are always much greater than errors of measurement in spectra with moderately good lines, and some such effect even though without any known cause is to be expected in this work.

Considering the relative dispersions in the two cases, the probable error of measurement of a single line is of about the same magnitude as those obtained by Adams, and corresponds to a linear error of less than half a micron, which is very good measuring for spectrum lines.

We may consider from these results that satisfactory values of the solar rotation can be obtained when the weather again becomes suitable, and we will hope in the next report to be able to give some definite results.

COMMITTEE WORK.

I had the privilege of attending two important astronomical meetings last year as a representative of our Observatory.

Our representation at the meetings resulted in unmistakable evidences of the standing we have already attained among observatories and scientific institutions, and will undoubtedly result in further increasing our reputation abroad.

The first of these was the annual meeting of the Astronomical and Astrophysical Society of America, which was held at Harvard College Observatory, Cambridge, August 17–19, and the second, the Triennial Conference of the International Union for Co-operation in Solar Research, which was held at the Mt. Wilson Solar Observatory, California, from August 31 to September 2.

At the first of these meetings, a very representative gathering of the leading astronomers of America, and also many noted astronomers of Europe, on their way to attend the Solar Conference, spent three days in the reading and discussion of papers on many phases of astronomical work. Several of the European astronomers presented papers on both astronomical and astrophysical problems, and their participation in the proceedings was much appreciated by the Society, to which several of them were elected to membership. A report containing abstracts of the papers read has been published in *Science*, and it is not necessary to repeat them here. It may be of interest to mention that my paper on 'The Probable Errors of Radial Velocity Determinations' was well received; and that I was chosen, in the absence of the author, Professor W. W. Campbell, to read what was undoubtedly the most important paper of the meeting, 'Some Preliminary Results deduced from Observed Radial Velocities of the Stars.' The substance of my own paper was given in detail in my report of last year, while Professor Campbell's discussed some very important results obtained from a study of the radial motion of the stars observed under his direction.

The reading of the papers was pleasantly varied on the afternoon of the 17th August by an excursion to the Blue Hill Meteorological Observatory, reached by electric car from Boston, where the meteorological apparatus, including the famous box kites, and the methods of observation, were examined by and explained to us. On the afternoon of the second day, an excursion to the observatory and astronomical department of Wellesley College was made, in which the majority of the members participated. Many original and ingenious methods in teaching astronomy were shown and explained to us, and we were also much interested in examining some of the novel apparatus in this finely-equipped students' observatory. The party were taken for a drive through the beautiful college grounds in automobiles, and before returning were served with tea. The social features of these functions added much not only to their pleasure but to the benefit derived from the meetings, in that they increased the good fellowship always so evident in astronomical gatherings, and thereby prepared the way for fruitful and useful discussions between the different members. On the afternoon of the third day, we were entertained at Harvard Astronomical Laboratory, where the students of Harvard College receive their astronomical training. After luncheon and inspection of the various original methods and apparatus employed in the teaching of astronomy here, the papers requiring lantern illustrations were then disposed of and the meeting was concluded.

Part of the work of this society is performed by means of committees appointed to deal with specific questions, the two already formed being on luminous meteors and on comets. The committee on comets presented a valuable report dealing with the preparations for and the results of the observations of Halley's comet, and, as a result of its labours, the comet was observed photographically at Hawaii by Mr. Ellerman and an important result was obtained from consecutive observations at Williams Bay, at Hawaii and at Beirut, Syria, on the acceleration of parts of the comet's tail, due to the repulsive force of the sun.

On the suggestion of Professor W. W. Campbell, a new committee to consider the question of co-operation in stellar radial velocity determinations was appointed and I have the honour to be one of its members. This committee consists of the following members: W. W. Campbell, Director Lick Observatory, California; E. B. Frost, Director Yerkes Observatory, Wisconsin; Frank Schlesinger, Director Allegheny Observatory, Pennsylvania; Karl Schwarzschild, Director Potsdam Observatory, Germany; H. F. Newall, Director University Observatory, Cambridge, England; and J. S. Plaskett, Dominion Observatory, Canada.

You will immediately recognize the five institutions named above as being the foremost in the world in astrophysical research, and that a representative of our observatory is included is, it seems to me, valuable evidence of the high standard of the work we are turning out and a tangible recognition of the standing obtained by the Dominion Observatory. This committee held a meeting on Mt. Wilson and discussed many of the questions involved. A report of the proceedings will be given below.

In accordance with the scheme carefully planned by Professor Hale to make the the solar conference as great a success as possible, the meeting of the Astronomical and Astrophysical Society was arranged for a date about two weeks previous to that of the Solar Union. This was done to enable many of the European astronomers to attend the earlier meeting, and then to travel across the continent with those members of the Astronomical Society who proposed to attend the Solar Union. This plan worked admirably, and a most congenial party of over thirty of the most eminent astronomers of the world travelled from Boston to Pasadena together in two special cars, starting from Boston on August 20, spending Sunday the 21st at Niagara Falls, and Monday, August 22, at Chicago. While in Chicago we were the guests of the University of Chicago, were driven to the grounds, had dinner at the University Club, and inspected the buildings and laboratories in the afternoon. I was particularly interested in the Ryerson Physical Laboratory and in the Michelson Ruling Engine, with which the grating whose tests are described in another place was ruled. Professor Michelson informed me that our diagnosis of the cause of the blurred edges of the spectra was correct and due to the lines of the ruling not being quite straight, and he promised to replace it by a better one.

The party was joined at Chicago by several American astronomers and travelled directly from there to Flagstaff on the Santa Fe railroad. The temperature on this part of the journey was excessively high, the thermometer being considerably over 90° in the cars. Nevertheless, the heat, although inducing the removal of all superfluous clothing, seemed to have little effect in quenching the astronomical enthusiasm of the party, and very interesting discussions on different phases of astrophysical research, especially stellar evolution, took place. Besides this, several committee meetings in preparation for the business of the Solar Union were held en route. The time of the whole journey passed most pleasantly and profitably, and the purposes of organizing the party in this way for promoting sociability, good feeling and astronomical discussion was very successfully carried out.

At Flagstaff the cars were placed on a siding to wait for a later train, and, by invitation of Director Lowell, the whole party visited the Lowell Observatory. The train arrived in Flagstaff about nine o'clock in the evening, and conveyances were waiting to drive us to the Observatory, where we were most hospitably received and shown the work of the Observatory. This was displayed by means of illuminated transparencies covering many branches of photographic astronomy, many of them being masterpieces of their kind. The photographs of the planets and of various regions of the sky were very fine, but, to my mind, the photographs of Halley's comet were superb, so far as I know much the best of any obtained. Photographic spectra, some of them most interesting, were also in abundance, and many other interesting examples of the Observatory's work. After being entertained at a supper by Mr. and Mrs. Lowell, the party were driven back to their cars where they spent the night. Many of us walked to the Observatory in the morning and saw the apparatus. Since my last visit a 4-foot reflecting telescope has been mounted, but has not yet, I believe, been much used. I should imagine the mounting was not sufficiently good for the best photographic work.

It had been planned that the party should make a stay of a couple of days at the Grand Canyon of the Colorado. Leaving Flagstaff at 11 o'clock on Thursday morning, August 25, the canyon was reached about 6 p.m. Two very pleasant days were spent here, one large excursion party and numerous small ones were organized, and astronomical discussions were still the rule, although not so universally so as on the train for the first few days. Some further additions to the party were made at the canyon. The last stage of the journey was begun on the evening of the 27th, and Pasadena was reached on Sunday, August 28, about 2 p.m. At the headquarters in Pasadena, the Hotel Maryland, a comfortable and homelike place, many members of the Solar Observatory staff were on hand to receive and welcome the members.

On the morning of the 29th, the Observatory offices, laboratories and shops were open for inspection by the visitors, and much admiration was expressed at the fine equipment. I was much interested in many parts of the equipment. In the spectroscopic laboratory a powerful grating spectrograph of 30-foot focal length is mounted vertically in a pit in the centre of the laboratory, and the various means of producing the light sources are arranged around this as a centre. Electric arc, spark and furnace, sunlight, luminous gases under pressure, powerful magnets for producing the Zeeman effect, indeed, practically everything that could be thought of is at hand and ready to be used at once without any delay in setting up and adjusting apparatus. A great deal of valuable work in connection with solar spectroscopy, such as the mapping of the effect of a magnetic field on the lines of the elements (Zeeman effect), the change in the character of a spectrum under different conditions of the light source, and different methods of producing the light source has been and is being done in this laboratory.

Much interest was evinced in the large grinding machine for grinding and polishing the 100-inch mirror. The imperfect disc for this mirror, which is being given by Mr. Hooker of Los Angeles, was in the shop, but at that time was not being worked on. Since then, however, as the prospects of obtaining a perfect disc were poor, grinding operations have been begun.

The star spectroscope, for use with the 60-inch reflector, had just been completed and was on view at the shop. It is arranged to use from 1 to 3 prisms, giving a large range of dispersion. Spectra made with a focal plane spectroscope of some interesting faint stars were on exhibition, and also some high dispersion spectra of the brighter stars made by means of the Cassegrain form of the reflector where the beam

of star light is reflected down through the polar axis to a stationary spectroscope of high dispersion.

The various measuring machines and the methods of testing optical surfaces came in for a good share of interest, while the workshop and instruments under construction also commanded attention. The Solar Observatory, so far as instrumental equipment and appliances go, easily holds the first place in the world.

On Tuesday morning, August 30, about 9 o'clock, a start was made for the summit of Mt. Wilson, which is at an elevation of nearly 6,000 feet. There are three methods of reaching the summit, on foot, on horse, mule or donkey back, and by carriage. There were only one or two enthusiasts who essayed the climb on foot, the trail having a length from the valley of about nine miles. A few went on the back of animals, but the majority seemed to prefer carriages. As I had previously made the trip on horseback I tried a carriage, but found it a change for the worse. The carriages go by what is called the new trail, a road built by the Observatory to enable the parts of the 60-inch reflector to be hauled to the summit. It is, however, a long and excessively dusty drive, it being well on towards evening before the peak was reached, and everyone being well coated with dust.

The party were accommodated at the Mt. Wilson hotel, sleeping in cottages and tents and getting their meals at the hotel proper. Considering the difficulty of getting supplies, the accommodation was good and the charges reasonable. A feature of the sessions was the afternoon tea at the Monastery, the bachelor quarters of the Observatory staff, a pleasant social function given by the lady members of the Observatory staff and much enjoyed by every one.

Much interest and admiration were felt by the delegates in the magnificent equipment for solar and stellar research on Mt. Wilson, and, before speaking about the sessions of the Union, it might be of advantage to briefly describe some of the most original and ingenious of the instruments used. I have, already, in my 1907 report to you (page 53) described the instrumental equipment of the Solar Observatory in 1906, and it will, therefore, suffice to speak of what has since been added, the two tower telescopes and the 60-inch reflector.

The 60-foot tower telescope is a radical departure from the horizontal coelostat telescope (the 'Snow' telescope) already described, in that the beam of light forming the solar image is vertical instead of horizontal. The coelostat and secondary mirrors are at the top of a steel tower 60 feet high, and the image is formed at a convenient distance above the surface of the ground by a 12-inch objective of 60 feet focus at the top of the tower. The spectrograph is consequently vertical, is of 30 feet focus and is placed in a pit 30 feet deep. There are evidently many advantages in this type of instrument over the 'Snow' telescope. The great height of the mirrors above the surface removes, or considerably reduces, the effect of the hot air rising from the earth and consequently improves the definition. The vertical direction of the image-forming beam reduces the danger of disturbance of definition arising from stratification or convection of the air. The placing of the spectrograph below the surface ensures that the lens and grating, which are nearly 30 feet down, are at almost absolutely constant temperature, a very important desideratum in accurate work. Finally, the difficulty due to the heating of the mirrors and the consequent change of focus and astigmatism produced, has been much reduced by making the coelostat and secondary mirrors about three times as thick as usual. It was shown by Ritchey that this change of focus was due to the heating of the front surface by the sun causing an actual bending of the mirror so that the surface became convex instead of plane, that this change of form was nearly regular, and, if the incidence was normal, would result in a lengthening of

the focus without seriously affecting the definition. But, owing to the fact that the beam is rarely or never incident normally on the plate mirrors, there results astigmatism and consequent disturbance of the definition. It was found that when the mirrors were made thick, as in this case (coelostat mirror 17 inches diameter, 12 inches thick), that the front surface became very slightly concave instead of convex owing probably to the heating of the edge of the mirror contained in the cell, and that possibly better results would be obtained if they were not quite so thick. The definition is in all cases considerably better than given by the 'Snow' telescope, and it can be used for long exposures without difficulty due to astigmatism or change of focus. Professor Hale showed us the image formed by this telescope and the Zeeman effect produced by the magnetic field around sunspots on the day he was on the mountain.

The 150-foot tower telescope was under construction last September, though so far completed that the solar image, about 17 inches in diameter, could be observed. When I saw it, however, the definition was not very good, and I have learned since that some difficulty has been experienced in getting good images. This may be due mostly to the much more perfect atmospheric conditions requisite with such an enormous focal length, and possibly partly to optical imperfections in some of the reflecting surfaces or in the image-forming objective employed. The well below the tower has a depth of nearly 80 feet, allowing the use of spectrographs of 75 feet focus, and enabling all the researches so successfully undertaken at Mt. Wilson to be prosecuted much further with this much more powerful equipment, to say nothing of the possibilities of other original work rendered feasible by the very large image and extraordinary dispersion available. The design of the whole telescope has been well thought out, all contingencies have been provided for, and it is most complete and will be most convenient in operation.

Probably the 60-inch reflecting telescope was the instrument which created the greatest interest and admiration, and excited the greatest envy among the visiting astronomers. It is certainly a magnificent instrument, complete in all details and leaving practically nothing to be desired so far as its optical and mechanical performance and the convenience, completeness and mechanical perfection of the details and accessories are concerned. It will not be necessary to give any description of the instrument here as that has been already given by the designer, Prof. Ritchey, in the 'Contributions from the Solar Observatory', Nos. 36 and 47. It will suffice to say that the completeness and the optical and mechanical properties of the reflector surprised every astronomer present. I think I am not mistaken when I say that very few astronomers expected that it would be possible, owing principally to atmospheric and to temperature changes, to obtain the wonderful definition that this instrument is capable of giving. Its photographic definition is very clearly shown by the examples of photographs of nebulæ, star clusters, etc., made by it. The wonderful detail in the nebulæ, and the surprising smallness of the star images excited the admiration of all. Through the kindness of Professor Ritchey, during two evenings on Mt. Wilson, the reflector was arranged for visual observations in the Cassegrain form, and every astronomer present observed several objects through it. It gave beautiful definition and showed wonderful light gathering power. Clusters, nebulæ and the planet Saturn were all observed, and those who had had experience with the largest refractors were convinced that it surpassed the best of them in many respects. Professor Ritchey is justly proud of his masterpiece, and he undoubtedly deserves great credit for the optical perfection of the mirrors and the excellent qualities of the mechanical design. On one of the nights spent on Mount Wilson the low dispersion spectrograph used in getting spectra of faint stars was attached, the reflector being used in the Newtonian form, the slit of the spectrograph being placed in the prime focus. The star images given were beautifully

hard and crisp and the exposures required to get measurable spectra surprisingly short. A spectrum of a fifth magnitude star, requiring upwards of an hour with our refractor, can be photographed with the same linear dispersion in about five minutes, an efficiency that particularly excited my admiration and even envy when I thought how our work could be extended if we had such an instrument.

The sessions of the Solar Union began on Wednesday morning, August 31, at 9.30, and continued for three days, Wednesday, Thursday and Friday. On motion of Professor Schuster, chairman of the Executive Committee, Professors Pickering of Harvard, Campbell of Lick, and Frost of Yerkes Observatories were chosen as chairmen for the three days of the meeting.

The opening business was an address by Professor Hale, who welcomed heartily all the delegates to the conference, and who then gave a desription of the work and instruments of the Solar Observatory and a discussion of some of the results achieved, with many suggestions for future efforts. This address was much appreciated, as, owing to a partial breakdown from overwork, it was the only meeting Professor Hale was able to attend. This was a source of great disappointment and regret to all the delegates, and must also have been very disappointing to Professor Hale himself who had worked so hard for the success of the meeting, and who was precluded from taking the prominent part in the meetings that he was so well fitted and entitled to do.

Professor Schuster read the report of the Executive Committee which referred to the loss to the Union by death of several members, it recommended the Union to urge the establishment of a solar observatory in Australia, and stated that the Royal Astronomical Society of Canada and the Bologna Academy had been elected constituents of the Union. It may be as well to state that the Union is composed of representatives or delegates from Societies and Academies, and that the work of the Union is done by committees representing the different phases of its work, these committees reporting at the meeting where the questions touched upon are discussed generally. There are committees on the determination of standard wave lengths, the measurement of the solar radiation, the spectra of sun spots, eclipse work, spectroheliographic work, and on the determination of the solar rotation by the displacement of the spectral lines.

After Professor Hale's address, Professor Kayser, the chairman, presented the report of the committee on the determination of standard wave lengths, which indicates a marked step forward in this important problem. Although Rowland's tables of wave lengths were, at the time of their introduction, a very great advance in accuracy over those previously in use, more recent work has shown that they are not sufficiently accurate for present-day research. Not only is the absolute value of the standard he employed in error, every wave length being too great by about one part in 30,000, which is not a matter of much moment, but that also there are relative errors of the order of one part in 100,000 among the different lines, which is much more serious than errors in the absolute values. These errors, due to unknown defects in the gratings employed, were only discovered when new measurements were made by a different method, that of interference. The work of this committee has been the determination by interferometer methods of the wave lengths of 50 lines in the iron arc between λ 4282 and λ 6495, which are called the secondary standards. The primary absolute standard is the wave length of the red line of cadmium, determined by Michelson in 1892 by actually counting the number of waves of this red line in a known fractional part of the standard metre. He found that there were 1,553,163.5 waves in a metre or that the wave length was 6438.4722 Å. The secondary standards have been determined by differential interference methods

by three observers, Fabry and Buisson, at Marseilles; Eversheim, at Bonn; and Pfund, at Baltimore. The accordance of these measures is so good that the range is generally less than one part in a million and the mean of the three is probably correct within that margin of error. The means of the three observers were adopted as the secondary standards. The following recommendations of the committee on wave lengths were, after discussion, adopted:—

> 1. In the region of the spectrum in which three independent measurements by the interferometer method of the lines of the iron arc are available, i. e., between λ 4282 and λ 6495, the arithmetical mean of the three measurements shall be adopted as definite international standards of second order, provided there is sufficient agreement between them.
>
> 2. The committee be given authority to publish these standards as soon as possible.
>
> 3. For the part of the spectrum in the neighbourhood of λ 5800, where the number and character of the iron lines is not satisfactory, the committee proposes the use of barium lines as additional standards.
>
> 4. Laboratories or observatories possessing first-rate concave gratings are invited to determine by interpolation, as soon as possible, standards of the third order in the spectrum of the iron arc within the above range (i. e., λ 4282 to λ 6495.)
>
> 5. The measurement of standards of the second order shall be extended to shorter and longer wave lengths, and the arithmetical mean of three independent determinations shall be adopted as secondary standards.
>
> 6. Standards of the third order shall then be obtained in the manner indicated.
>
> 7. The above system of standards shall be called the international system, the unit on which it is based being called the international unit (denoted I. A.) as defined by the conference of 1907.
>
> 8. It is very desirable that in different laboratories, possessing concave gratings of the first quality, photographs of arc, spark, and solar spectra and new measurements according to the international system shall be taken as soon as possible.

It will be noted that in the determination of the tertiary standards and in the new measurements of arc, spark, and solar spectra, it is expressly stated that first quality concave gratings be used to make the photographs. In view of the fact that there are now many plane gratings in use in an autocollimation or Littrow form of spectrograph, of which our solar spectrograph is an example, it seemed desirable to get an expression of opinion from the committee as to the suitability of such instruments for this purpose, and I therefore proposed that the plane grating might be used in this work. Professor Kayser, the chairman of the committee, was strongly opposed to the idea for the reason that the spectra formed were not normal, even though, as I pointed out, the deviation from normality was small and could readily be allowed for. The matter was allowed to stand there until it was brought up at a later meeting, when my views were strongly supported by Messrs. Adams, St. John, Newall, and others, who gave examples of the accuracy attainable with the plane grating used in the way stated above, and it was finally agreed that the tertiary standards and new measurements of spectra might be obtained with the plane grating.

This is a work that might well be undertaken here by the use of the first-rate plane grating we now possess and the excellent Toepfer measuring machine which are both well adapted for the purpose. It would be necessary to obtain an additional assistant for the purpose of measuring the plates, as there would be so great a quantity required, entirely beyond our present capacity unless the other work were neglected.

The work of this committee is perhaps of the greatest present importance of any dealt with by the Solar Union, and I have therefore presented it in some detail.

In the evening, Director C. G. Abbot, of the Smithsonian Astrophysical Observatory, gave a popular lecture on the 'Solar Constant of Radiation,' outlining the history of the subject, naming the various values of the constant accepted at different times, and giving a brief account of his own work. Mr. Abbot presented a strong plea for the support of a project to equip and maintain another station in a suitable locality, where independent similar and simultaneous observations might be secured to substantiate the value of the constant and determine if there is any fluctuation.

On Thursday morning, the first business taken up was the report of the committee on the measurement of the solar radiation, which was presented by Professor Abbot. The gist of the report was that numerous independent and concordant observations made at Washington and Mount Wilson in recent years have shown the value of the solar constant to be about 2.0 calories per square centimetre per minute, and that fairly well warranted indications of variability to the extent of 5 or 10 per cent. were indicated. It was recommended that an additional station for continuous observation of the solar constant over a considerable period be equipped in a suitable location. A discussion took place on the relative merits of different types of pyrheliometers and on the durability of measuring the radiation over different portions of the solar disc.

The report of the committee on the spectra of sunspots was next presented by Professor A. Fowler, the chairman. One of the most important statements in this report was that the spectra of sunspots are as constant in nature as the ordinary Fraunhofer spectrum. Father Cortie said he had examined them for twenty years and thinks them quite unchanged through periods of maximum and minimum spot activity. After some discussion the following resolutions were adopted:—

1. That the reports of the committee and the co-operating observers be printed in the Transactions of the Union in full, or in abstract as circumstances may determine.

2. That notwithstanding the photographic results, visual observations are desirable and the committee should be continued.

3. That the committee be requested to prepare and circulate a revised scheme of observations.

4. In view of the fact that several observers have prepared catalogues of great numbers of sunspot lines, it is desirable that these results be collated.

5. It is desirable that the new map of the sunspot spectrum do not exceed 60 cm. in length and be on a scale of 5 mm. to one Angstrom.

The report of the eclipse committee, in the absence of the chairman, Sir Norman Lockyer, was presented by the secretary, Comte A. de la Baume Pluvinel, and excited some little discussion over the method of recording angles of position around the sun's disc, which was finally decided in favour of from north toward east.

The desirability of co-operation in observing the chromospheric spectrum was discussed, and Professor Campbell described a method of using a moving plate holder for recording the flash spectrum.

This closed the formal business for Thursday, but in the evening, Professor Kapteyn gave an extremely interesting lecture on 'Star Streaming of Stars of the Orion Type' which, in addition to being the record of a notable piece of work, was presented in a very pleasing and lucid manner and was much enjoyed by the large number present. He finds that two large groups of Orion type stars, containing nearly all of this type in the sky, are moving, when the solar motion is allowed for, in opposite directions at the same rate.

On Friday morning the report of the committee on the determination of the solar rotation by means of the displacement of spectral lines was presented by Mr. Adams. As this committee is one of which I am a member a full report will be given later.

In the absence of Professor Hale, the chairman, the report of the committee on spectroheliographic work was presented by Professor Frost. It included separate reports from Father Cirera, of Tortosa, Spain, on the classification of faculæ, from Professor Rieco, of Catania, Sicily, and Professors Fox and Slocum of the Yerkes Observatory, giving details of spectroheliograph plates obtained. The resolutions proposed by the committee and adopted by the Union are substantially as below:—

1. That daily photographs of calcium flocculi be continued.
2. That provision be made for the measurement of the photographs.
3. That the Japanese Government be approached in regard to the establishment of a solar observatory in Japan.
4. That the observatories of Tacubaya, Mexico, and Madrid, Spain, be added to the list of co-operating observatories.
5. That the committee recognises the advisability of the use of spectroheliographs of high dispersion.
6. That the fund raised in Italy as a memorial of Father Secchi be devoted to the construction of a tower telescope.

On Friday afternoon the question as to whether the field of the Solar Union should be extended to include the study of stellar spectra was discussed. It was pointed out by Professor Newall that the recent work of Campbell, Kapteyn, Russell, and others, tended to upset our notions of the manner of evolution of stellar systems and would render the problem of discussing stellar types somewhat unsettled, and he questioned the necessity of appointing a committee. Professor Schuster remarked that the same persons who are studying the sun are studying the stars, and that some have not joined the Solar Union because it is devoted only to the sun. It would soon be necessary to consider the question of stellar classification and there was no body so representative as this for doing so, while it would naturally devolve on the Union, sooner or later, to take up stellar questions with which solar research is so intimately connected. Professor Turner referred to the work of the Astrographic Chart which was also being extended, and he thought that the course of events would be such that the two international organizations would fill the field of astrometry and astrophysics. Other members spoke in favour of extending the scope of the Union, and the motion was carried unanimously. A full report of the deliberations of the committee on spectral classification, which was immediately appointed, and of which I have the honour to be a member, is given below.

After the decision to hold the next meeting at Bonn, in 1913, the appointing of committees, and the passing of resolutions of thanks, the 1910 sessions of the International Union for Co-operation in Solar Research was formally closed. There remained, however, the journey down the mountain which only occupied about four hours and was much more pleasant than the climb up, and the closing function, a banquet given by Professor and Mrs. Hale to the members and those accompanying them, about one hundred in all, at the Hotel Maryland, on Saturday evening. Owing to the indisposition of Professor Hale, to the disappointment of many there, there was no toast list. Professor Kayser proposed very pleasantly the health of Professor and Mrs. Hale, which was fittingly responded to by Professor Hale. The preparations had been made with the greatest care and the menu and service were excellent. It was a fitting close to a memorable meeting.

By Sunday evening nearly every delegate had left Pasadena, most of them going northward and visiting the Lick Observatory and the University of California before going east. I spent one night at the Lick Observatory and renewed acquaintance with the staff and the methods before starting homeward.

Aside from the direct advantages derived from my attendance as representative of our Observatory at these meetings, which will be referred to later, it is possible that such direct advantages are more than outweighed by the indirect benefits such as, the inspiration received, and the enthusiasm heightened by the association and discussion of questions of mutual interest with fellow astronomers. This is especially true in the present case owing to the notable character of the gathering, the most representative and world-wide meeting of astronomers ever held in America.

I propose to give a more full account of the three committees to which I had the honour of being appointed, inasmuch as they have a more direct bearing on our work than the others above mentioned. The first of these connected with the Astronomical and Astrophysical Society of America was:

The Committee on Co-operation in the Determination of Stellar Radial Velocities.

As previously stated, this committee was organized at the request of Professor Campbell, Director of the Lick Observatory, at the Boston meeting of the Society, and consists of the following members:—

W. W. Campbell, Director, Lick Observatory.
E. B. Frost, " Yerkes "
Frank Schlesinger, " Allegheny "
Karl Schwarzschild, " Potsdam "
H. F. Newall, " University Observatory, Cambridge.
J. S. Plaskett, Dominion Observatory.

The other five institutions represented in this committee are the foremost in the world in astrophysical research, and it is an honour for the Dominion Observatory to be associated with them.

This committee held a meeting on Mount Wilson on Thursday afternoon, September 1, when the six above mentioned attended, and, by invitation, Professor J. Hartmann, of Göttingen, and V. M. Slipher, of Flagstaff. At this meeting, the question of the necessity and advisability of co-operation in determining the radial velocities of stars fainter than the fifth visual magnitude was discussed. It seemed to be the general opinion that it was impracticable for any observatory, with its present equipment, other than the Lick, with its large and efficient telescope and unrivalled climate, to take any effective part in obtaining high dispersion spectra of such faint stars, no matter how willing they would be to co-operate in such work. An informal discussion took place upon possible means of overcoming the enormous

wastefulness of light in the modern stellar spectrograph, and two or three schemes were suggested for helping matters. Professor Newall proposed to use a crystal of some neodymium salt, or other absorbing material capable of producing lines, in place of the slit, where approximately nine-tenths of the light is lost, so that the spectrograph would act similarly to an objective prism and yet have the good qualities as regards temperature correction and freedom from flexure of the modern spectrograph. Professor Campbell proposes to use a single-prism spectrograph for the fainter stars, but to avoid some of the absorption and reflection troubles and difficulties with flexure of the ordinary one-prism type, to make it of the Littrow form, using a half-prism silvered to return the light back along its original path, and tipping the prism slightly to bring the spectrum to one side of the slit. Other suggestions in regard to the use of objective prisms were made, but no definite plans proposed. I proposed to try a grating as the dispersion piece if one sufficiently bright in one order could be obtained. As in the prism train of the modern spectrograph, about 70 per cent. of the light is lost by absorption and reflection, it is evident that a grating throwing say 60 per cent. of the incident light into one order will effect a considerable saving. Unfortunately, although such a grating was ordered six months ago, it has not yet been obtained, but, when it is, should be well worth trying. It was tacitly agreed that as much as possible along the lines of improving the efficiency of the spectrograph should be done before the next meeting of the committee. It was also understood that any one of the members having the good fortune to secure a telescope of larger aperture, should co-operate with Professor Campbell in obtaining the spectra of the fainter stars. The radial velocities of practically all stars to 5.0 visual magnitude have already been obtained at the Lick Observatory and its southern branch at Santiago de Chile. The determination of the radial velocities of stars fainter than the fifth magnitude is one of the most pressing problems of modern astronomy, as upon the knowledge of such radial velocities depends the solution of many statistical studies of the constitution, motions, and dimensions of the sidereal universe.

The observatory that is able to take an active and efficient part in obtaining such radial velocities will deservedly take high rank in the scientific world. It seems to me to be an opportunity for enhancing our country's reputation that should not be missed, for a telescope, larger than any in use and one which will enable correspondingly fainter stars to be observed, can be obtained at a comparatively moderate outlay. Some approximate information in regard to this has been given previously. With our experience and record in obtaining accurate radial velocities with the smallest telescope in use in this work, there should be no difficulty in making, with the largest instrument, an unrivalled and exceedingly valuable series of observations; and also, for Canada's Observatory, a reputation second to none.

Since the meeting and in preparation for the coming meeting of the Astronomical and Astrophysical Society to be held in Ottawa next August, I, with the other members, have received a provisional report of the proceedings of the committee from Professor Campbell, with a request to criticise it and to supply any omissions. I give here a copy of his report and of my reply, which should be self explanatory.

Professor W. J. Hussey, Secretary,
The Astronomical and Astrophysical Society of America,
Detroit Observatory,
Ann Arbor, Mich.

Dear Sir,—In response to my letter of suggestion and recommendation, dated August 9, 1910, that the Society appoint a committee 'to study and report upon the subject of co-operation on the part of observatories engaged

in the measurement of stellar radial velocities,' your letter of August 22, 1910, informed me that my communication was presented to the Council and that 'the matter was discussed and then referred to a committee consisting of the following persons, with power to add to their number:—

W. W. Campbell.	J. S. Plaskett.
E. B. Frost.	Karl Schwarzschild.
Frank Schlesinger.	H. F. Newall.'

The suggestion of the Council that this committee might well hold a meeting at the time of the Solar Union Conference was adopted, and the committee met at Mount Wilson on September 1, 1910. Present: Campbell, Frost, Schlesinger, Plaskett, Schwarzschild, Newall; and by invitation, Hartmann, of Göttingen, and Slipher, of Flagstaff.

The credentials of the committee seemed to be ambiguous as to whether the committee was empowered to present a report upon the main question, or whether its duties were limited to considering and reporting upon the wisdom of appointing a committee to deal with the main question; but we adopted the former of the two views, and we discussed the points which co-operation would bring up first for decision.

My original letter had made prominent the desirability of co-operation in determining the radial velocities of stars fainter than 5.0 visual magnitude in the 'Revised Harvard Photometry'; co-operation on stars brighter than 5.0 not seeming essential, as the programme of the Lick Observatory, on Mount Hamilton and at Santiago, Chile, embracing stars down to 5.0, were essentially complete, not including the investigation of spectroscopic binary systems, nor stars whose spectra contain lines too poor for satisfactory measurement under high dispersion.

I expressed the hope that we should be able, within one or two years, to begin upon an extensive programme for the determination of radial velocities of stars between 5.0 and 6.0 visual magnitude, and that this work might be shared by several observatories. The response of nearly all those present (except myself) was to the effect that, however strongly they might desire to engage in the suggested co-operative plans, their instrumental resources were too weak to give promise of coping successfully with many stars fainter than 5.0 visual magnitude; and, further, that their fields of greatest present usefulness consisted in the study of specially interesting stars, such as the known spectroscopic binary systems, which are for the most part brighter than 5.0 visual magnitude. In effect, the committee decided that co-operation in the determination of radial velocities for stars fainter than 5.0 visual magnitude is at the present time not practicable, and I was requested to present a report embodying this decision.

At that time it was not known that the Carnegie Solar Observatory contemplated the making of stellar radial velocity determinations. A few months following the meeting of the committee, Professor Walter S. Adams, acting director of the Carnegie Solar Observatory, consulted with me concerning a practicable programme of radial velocity determinations for the Solar Observatory, and we have been considering the subject in correspondence. It is not improbable that the main radial velocity programmes of the Lick Observatory on Mount Hamilton and in Chile, and of the Solar Observatory during the next few years will be upon a co-operative basis, to the extent that the Lick Observatory programme will include stars between 5.0 and 5.5 visual magnitude, and the Solar Observatory programme (for

observation with the 60-inch reflector) will be composed of stars fainter than 5.5 visual magnitude. However, the decision of many questions relating hereto awaits the return of Professor Hale to active duty in the Solar Observatory.

No action was taken as to recommending that the committee be continued or discharged.

I personally regret that the number of observatories prepared to engage in co-operative programmes is so small, and hope that the not distant future may lead to a decision more favourable to co-operative plans. Those of us who have had occasion to base investigations concerning the sidereal system upon radial velocity results have constant regret that the number of available velocities is not greater. The number of stellar radial velocities now known, not counting uninvestigated spectroscopic binary systems nor stars whose spectral lines are too poor for satisfactory measurement, is in the neighbourhood of 1200. It is my hope and personal belief that within two decades we shall know the radial velocities of as many stars as are now contained in catalogues of stars whose proper motions are fairly determined.

Respectfully submitted for the committee,

W. W. Campbell,
Chairman.

Professor W. W. Campbell,
Chairman Committee on Co-operation in Radial Velocities.

Dear Sir,—In reference to the provisional report of the committee on co-operation in radial velocity work, which you have been so good as to send me, I would say that it represents to the best of my recollection the general trend of the discussion at the meeting on Mount Wilson.

There seemed to be, however, at the meeting a feeling that, although the instrumental equipment at most observatories was not sufficiently powerful to successfully undertake the observation of stars fainter than 5.0 visual magnitude, it might be possible to overcome part of the enormous loss of light which takes place in the modern spectrograph, and to so increase the efficiency that, even with the present light gathering power, fainter stars might be successfully observed. It was agreed, I believe, that those who were unable to co-operate at present should endeavour, by investigation and experiment, to evolve a method by which some of the great loss of light might be obviated. There was some discussion in regard to the use of the objective prism with the absorbing screen devised by Professors Pickering and Wood, and I understand that Professor Newall is to experiment along that line. A further proposal was to experiment with gratings so ruled as to diffract the greater part of the light into one order. I may say that we have an order at Baltimore for such a grating with good prospects that the order will soon be filled. We have at present a 6″ plane grating in which about 45% of the incident light is thrown into the 1st order on one side, an efficiency which is considerably greater than that given by the prism train of the modern three-prism spectrograph. You, I believe, propose to use the Littrow form of spectrograph with a silvered half-prism as dispersing piece.

I feel personally much regret that at present we are unable to co-operate in determining the radial velocities of stars fainter than 5.0 visual magnitude, and can assure you that if we had the necessary equipment we would be not only willing but anxious to engage in such a scheme. Furthermore, as soon as we are able to obtain

greater light gathering power we would be glad to devote the greater part of the time in such a cause, which is I think one of the most urgent in present day astronomy.

In regard to the last paragraph of the report I see no reason whatever why it should not be included and heartily concur in the hope therein expressed.

Yours very truly,

J. S. PLASKETT.

Committee on the Determination of the Solar Rotation by the Displacements of the Spectral Lines.

A committee on this research was originally appointed at the Meudon meeting of the Solar Union, but, as no secretary was appointed nor scheme outlined, little has been done in the direction of co-operative work. Previous to the meeting at Mount Wilson, Mr. Adams, who has completed a splendid determination of the solar rotation, sent a letter, somewhat along the lines of the report below, to those whom he thought would be interested in the work. As a result of this letter, a meeting was held on the afternoon of Thursday, September 1, at which were present all the members who had undertaken or were likely to undertake work along this line. This meeting was most enthusiastic and business-like, and as every one was in earnest a definite working programme was soon outlined. Co-operation was carried in this scheme to an extent sufficient to prevent overlapping, to enable accurate comparisons of results, etc., to provide for elimination of systematic errors, without in any way hampering individuality of treatment or originality of methods. The basis of the agreement as will be seen in the report was the division of the spectrum into 7 regions, one for each member of the committee. These regions extend from λ 3800 to λ 6250. Each observer is to determine the rotation from the region of spectrum allotted to him about 200 A in length and in addition from a general or common region observed by all. This region was chosen between λ 4220 and λ 4280, the centre of the region used by Adams in his determination.

The latitudes to be observed are 0°, 15°, 30°, 45°, 60° and 75°, and, if possible, higher latitudes between 75° and the pole in the special regions, and 0°, 30° and 60° in the common region.

At the meeting of the Union on Friday morning, the provisional report was read, including the basis of agreement reached in the organization meeting, and was accepted with little discussion, but with congratulations on the business-like and complete nature of the report, and the following committee was formally appointed as the Rotation Committee of the International Solar Union. I give here the region of spectrum allotted to each.

3800–4000	Bélopolsky	Pulkova
4000–4140	Schlesinger	Allegheny
4300–4500	Newall	Cambridge
4500–4700	Adams	Mt. Wilson
5100–5300	Adams	Mt. Wilson
5500–5700	Plaskett	Ottawa
6250–6350	Dyson	Edinburgh

A copy of the report is herewith appended.

'The organization of the Committee on the Rotation of the Sun appointed at the Meudon meeting of the International Solar Union has never been completed

by the appointment of a secretary, and little has been done in the direction of co-operative work. At a meeting of the committee yesterday, however, a temporary organization was effected and a full programme of work discussed.

'The principal objects of a study of the sun's rotation by means of the displacements of the spectrum lines may be referred to under five heads:—

1. The accurate determination of the angular velocity of rotation at various latitudes, and the derivation of a formula representing with a high degree of precision the variation of velocity with latitude.

2. A definite conclusion as to the existence of secular or periodic variations in the sun's rate of rotation.

3. The investigation of the rate of rotation as shown by the lines of different elements, and of the arc and enhanced lines of the same element, with a view to determining whether either the absolute rate of rotation or the law of variation with latitude differs for different substances.

4. The study of lines selected from different regions of the spectrum.

5. The detection of possible systematic proper motions or drifts in the sun's reversing layer.

'At the present time the evidence appears to be strong that the type of formula

$$\xi = a + b \cos^2 \phi$$

connecting angular velocity ξ and latitude ϕ, first suggested by Faye as the result of his discussion of the observations of the motion of sun-spots, represents with a considerable degree of accuracy the results obtained from spectrographic observations. The series of observations by Dunér, Halm and Adams are all tolerably accordant in this respect. It is, however, by no means certain that a term in $\cos^4 \phi$ may not exist. The effect of such a term would, of course, be most marked in the higher latitudes where observations are most difficult and the influence of errors in position angle is most serious. At 75° of latitude, for example, an error of 0°.38 in position angle would correspond to about 0.01km. in linear velocity or 0°.3 in angular velocity. It is clear that observations in the higher latitudes are greatly needed, and that for this purpose a large solar image is very desirable.

'The question of a variation in the sun's rate of rotation is still an open one, although the evidence at present is rather opposed to the existence of short period variations of any considerable amount. Systematic observations covering at least two sun-spot maxima and minima are required for the purpose of determining a possible relationship between the sun's activity and its rate of rotation.

'The observations of Pérot' Schlesinger and Adams during the last two years are all in agreement in showing that the lines of different elements give different rotational velocities. The elements showing the greatest apparent differences of level in the sun's atmosphere appear to give the largest differences in rotational velocity. Among the high level elements are hydrogen and calcium, and among the low level elements cyanogen and lanthanum. The number of elements investigated should be considerably increased in future work, and in particular such should be included as are of low or very high atomic weight. The important result, apparently indicated by the Mount Wilson observations, that the law of change of velocity with latitude as well as the absolute velocity differs for different elements, requires much additional study. It now seems probable that the investigation of the behavior of special lines will soon form one of the most important branches of the subject of the sun's rotation.

' The change from visual to photographic methods of observation has led naturally to a change in the region of the spectrum employed from the longer to the shorter wave-lengths. Thus at the present time, Professor Plaskett is using the region from about λ 4430 to λ 4600, Dr. Schlesinger λ 4060 to λ 4140, and the Mount Wilson observers from λ 4100 to λ 4300. As compared with these, the visual observations of Dunér and Halm were made on two iron lines near λ 6300, while the interferometer results of M. Pérot were based on two lines of calcium at λ 5349 and λ 6122. It seems very desirable, in view of the possibility of a relationship between the values of the rotational velocity and the region of the spectrum observed, that a large range of spectrum be covered by the various series of observations.

' With the recent marked improvements in methods of sensitizing photographic plates to the less refrangible part of the spectrum, it will not be difficult to secure satisfactory photographs on fine-grained plates of any portion of the visible spectrum.

'The fifth and last point under consideration in the general discussion is that of proper motions in the sun's reversing layer. A striking case of this sort in the vicinity of two sun-spots was observed by Adams at Mount Wilson in 1908, but, except for this isolated case, practically nothing is known regarding their occurrence in the solar atmosphere. Any knowledge as to their prevalence or direction of motion will prove of the greatest importance in the theory of the general solar circulation.

'In view of these considerations regarding the present condition of our knowledge of the rotation of the sun, the committee at its meeting undertook the organization of co-operative work, and to this end made the following recommendations to observers:—

1. That the observers select, at least to a partial extent, different regions of the spectrum so that the total range of wave-length under observation may be as great as possible.

' By general consent of those present at the meeting of the committee, the following regions of the spectrum were selected by the various observers:—

3800—4000	Bélopolsky.
4000—4140	Schlesinger.
4300—4500	Newall.
4500—4700	Adams.
5100—5300	Adams.
5500—5700	Plaskett.
6250—6350	Dyson.

2. That within these regions the selection of lines be made with a view to the inclusion of a considerable number of elements, particularly such as are of very high or very low atomic weight, as well as the enhanced and the arc lines of the same element.

3. That an agreement be made upon the latitudes to be observed.

'After considerable discussion the committee decided to recommend the following points of heliographic latitude:—

0°, 15°, 30° 45°, 60°, 75°.

4. That an especial attempt be made to secure observations in the highest latitudes, particularly between 75° and 90°.

'One or two of the observers present expressed their willingness to attempt determinations at latitudes 80° and 85°.

5. That a short list of selected lines be employed by all of the observers in common, the results to serve as a check upon instrumental or personal errors, and that a list of the points of latitude to be observed accompany this list.

'The Committee selected for this purpose the portion of the spectrum between λ4220 and λ4280, and the three points of latitude 0°, 30° and 60°. The secretary was authorized to choose a list of lines and forward it to the various observers for approval.

6. That an attempt be made to secure at least one independent series of observations in each of the solar hemispheres with a view to determining a possible difference in the rate of rotation.

'Several observers expressed their willingness to undertake such observations of this character as the construction of their instruments would permit.

'Since the meeting held yesterday is the first since its appointment, the committee does not desire at this time to offer a formal set of resolutions, but rather to secure authorization from the International Union for Co-operation in Solar Research to proceed along the lines indicated in this report until the next meeting in 1913. At that time it should be possible to offer a definitive series of conclusions for action by the International Union.'

There is little to add to the above report, which practically tells the whole story of what has been arranged as regards co-operative work on the solar rotation. Since the meeting Professor Adams sent around a list of six iron lines for observing in the common region. At my suggestion the list was increased to ten and was slightly changed to include some of those observed by Adams to give either higher or lower values than the general reversing layer. The following are the ten lines selected with the element, intensity and whether it gives high or low velocity as observed by Adams. In addition to the ten I propose to measure five other lines which gave varying velocities according to Adams. The latter are given below the general list.

Lines to be measured in General Region.

Line.	Element.	Intensity.	Remarks.
4220·509	....	3	
4225·619	....	3	
4232·887	....	2	
4241·285	....	2	
4246·996	....	5	
4257·815	....	2	High Value.
4258·477	....	2	
4266·081	....	2	High Value.
4268·915	....	2	
4276·836	....	2	
	Additional Lines.		
4196·699	....	2	Low Value.
4197·257	....	2	Low Value.
4216·136	....	2	Low Value.
4290·377	....	2	Low Value.
4291·630	....	2	High Value.

The result of the measurement of these lines should be of considerable interest on comparison with the values obtained by Adams.

Committee on Classification of Stellar Spectra.

The discussion resulting in the appointment of this committee has already been given in this report. Immediately after the close of the general meeting on Friday, this committee at the call of the chairman met and discussed the question informally. The gist of that discussion is given in a circular letter issued later by the secretary, Dr. Schlesinger, which is given in full below. Beneath it is a copy of my reply to the questions raised therein. The members of the committee, which is very representative, including practically everyone working on stellar spectroscopy, are given in the secretary's letter.

Allegheny Observatory, Nov. 7, 1910.

Dear Mr. Plaskett.—At the Fourth Conference of the International Union for co-operation in Solar Research, the following gentlemen were appointed to serve as a "Committee on the Classification of Stellar Spectra":—Messrs. Adams, Campbell, Frost, Hale, Hamy, Hartmann, Kapteyn, Newall, Pickering (*Chairman*), Plaskett, Russell, Schlesinger (*Secretary*) and Schwarzschild.

This committee met on Mount Wilson on September 2, immediately after the adjournment of the conference itself. In accordance with power to add to their number, it was unanimously decided to ask Mr. Küstner to serve, and he was present at this meeting. Messrs. Hale and Campbell, who had already left the mountain, were the only absentees.

The chairman called upon each member in turn to express his views concerning the classification of stellar spectra and his opinion as to what the scope of the committee should be. A brief summary of this discussion follows:—Mr. Adams preferred the Draper Classification*, and thought that, if the members of the committee themselves would use this classification exclusively, until say the next meeting of the Solar Union, it would go far toward establishing uniformity. Mr. Küstner preferred the Draper Classification and was using it exclusively. Mr. Hartmann thought that the Draper Classification was the best that had been proposed, but hoped that an effort would be made to retain the Roman numerals of Secchi, that have now become classic, and that the subdivisions be made as in the Draper system by the addition of Arabic numerals; thus,II,3. Mr. Schwarzschild expressed similar views, and thought that it might be advantageous to employ both Secchi's numerals and Pickering's letters; thus, IIG5. Mr. Russell suggested the advisability of substituting some method for *measuring* the type of spectrum for the *estimations* that are now employed, and asked whether this could not be applied to the Draper Classification. Mr. Plaskett preferred the Draper Classification, but said that as he believed uniformity to be the prime consideration he would gladly adopt whatever system could be agreed upon. Mr. Frost thought that the committee should make no recommendation at the present time but should first canvass the whole subject thoroughly; it appeared to him desirable to investigate the visual end of the spectrum in connection with the photographic before arriving at a definite conclusion. Mr. Schlesinger preferred the Draper Classification and had decided to use it exclusively; he called attention to the desirability of making further distinction among the numerous spectra that are now classified as A without any modifying number; he thought that any attempt to establish a temporary uniformity now might prove an obstacle to the universal adoption of some more

* This classification is described in the Annals of Harvard College Observatory, Volume LVI, page 66. The letters O, B, A, F, G, K, M and N are used to designate the sequence of the spectra. Numerals from 1 to 9 after the letter denote intermediate spectra; thus, B3 would be assigned to a spectrum between B and A, but more nearly resembling the former.

definite system later. Mr. Newall asked whether a spectrum might not be intermediate between two letters in the Draper Classification that are not consecutive, as A5G. Mr. Pickering said in reply that such cases have not arisen in practice. Mr. Newall raised the question whether the committee should not consider the matter of stellar evolution. The members present seemed to be of the opinion that this was legitimately within the scope of the committee, but that its immediate business should be the establishment of a uniform system for classification. Messrs. Russell, Hartmann, Kapteyn and Schlesinger urged that no evolutionary basis for a classification be adopted at the present time; astrophysicists are not agreed as to the proper sequence from this point of view; if our ideas upon this matter should be modified in the near future (as seems very possible), then it would be necessary to modify or to abandon altogether any system of classification based upon these ideas. For similar reasons Mr. Russell asked that the use of such terms as "early" and "late," now so frequently used in describing spectra, be discontinued in favor of "white" and "red."

The secretary was directed to secure by correspondence as full an expression of opinion as possible, from the members of the committee and others, on the matters that had been discussed. The meeting adjourned.

In accordance with this request, the following questions have been framed*, and you are asked to reply to them at length. In addition it is hoped that you will give your view in full upon any other points that may occur to you as being important in this connection.

(1). It will be noticed that, at the meeting reported above, there seemed to be a practically unanimous opinion that the Draper Classification is the most useful that has thus far been proposed. Do you concur in this opinion? If not, what system do you prefer?

(2). In any case, what objections to the Draper Classification have come to your notice, and what modifications do you suggest?

(3). Do you think it would be wise for this committee to recommend at this time or in the near future, any system of classification for universal adoption? If not, what additional observations or other work do you deem necessary before such recommendation should be made? Would you be willing to take part in this work?

(4). Do you think it desirable to include in the classification some symbol that would indicate the width of the lines, as was done by Miss Maury in Annals of the Harvard College Observatory, Volume XXVIII?

(5). What other criteria for classification would you suggest?

Although it is not the intention of the committee to frame a formal report at once, it is desirable that your answers to some of these questions should be forthcoming very soon; this is particularly the case with the third question. May I therefore request that your reply be sent, if possible, so as to reach me not later than the end of this calendar year? If you can secure an expression of opinion from any other qualified astronomer, it will be very welcome.

Very respectfully yours,

FRANK SCHLESINGER,

Secretary of the Committee.

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* The general form that these questions should take was discussed at several informal meetings on the train coming east from the meeting at Pasadena. There were present at these meetings the Chairman and the Secretary of the Committee, Mr. Russell and (by invitation) Father Cortie.

Ottawa, Ont., Jan. 26, 1911.

Dr. Frank Schlesinger,
Secretary International Committee on Classification of Stellar Spectra.

Dear Sir.—In reply to the questions formulated in your letter of November 7th last, in regard to the Classification of Stellar Spectra, I have pleasure in presenting the following.

1. The Draper Classification is the most useful scheme hitherto proposed, but it is possible that it might be improved upon in some respects.

2. The principal objection to the Draper Classification occurring to me is that the designations of the different types of spectra do not of themselves suggest anything in regard to the character of the spectra, and are in this respect arbitrary and unsatisfactory. It is of course true that familiarity with and use of the Draper system soon diminishes the weight of this objection, but for those using or referring to it occasionally a system of nomenclature which would at once suggest the type of spectrum designated would be a decided advantage, and I would suggest that the committee consider the possibility of such a modification. Would it be possible to combine the simplicity and the universally known features of Secchi's nomenclature with the more complete, systematic, and consecutive division of the spectral types in the Draper Classification? There is of course the objection that one would have a tendency to associate the order of the numerals therein used with the order of stellar development, and this, considering the present state of our knowledge of stellar evolution, would be inadvisable. A similar objection may be urged to the designation of the Draper subdivisions in that they are always used in one order; thus, always A4F never F6A, tacitly assuming that stars develop from the A to the F types and not, as may be possible, from F to A.

3. In my opinion, the question in all its bearings should be discussed as fully as possible by correspondence, so that at the next meeting of the Solar Union at Bonn in 1913, the committee may be prepared to recommend some scheme of spectral classification for universal adoption. It does not seem to me advisable to formulate any system before that date, as it can only be put into satisfactory shape after personal meetings and discussions among the members, and such meetings will not likely be possible until the next Solar Conference. On the other hand, the only thing that would justify a longer delay than that necessary for a full consideration of the question would be the chance of obtaining, in the near future, some more positive knowledge of the order and process of stellar evolution than we at present possess. The probability of a final solution of that problem is not in my opinion sufficiently great to justify a long postponement of the advantages that will undoubtedly accrue from the adoption of some uniform system of spectral classification.

It seems to me desirable before a definite classification is adopted that some work be done on the red end of stellar spectra up to and including H_α. It is possible that very valuable criteria for the division and distinction of the various types may be obtained from the behaviour of some of the lines, such as the sodium "D", the helium "D_3" and the magnesium "b", between H_α and H_β. It would be necessary to obtain, with a reasonably high dispersion, not less than 50 A per mm., photographs of the red end of the spectrum of representative stars of the different spectral subdivisions, before it could be determined whether any modifications of existing divisions would be required. Such work and any further work that might develop I would be willing to take part in.

4. It seems to me to be essential, or at least very desirable, in any complete system of classification to introduce some method of representing the width of the lines. It is undoubtedly true that there is frequently much greater difference in the appearance of two stars of the same type, one with wide and one with narrow lines, than between two stars, each with narrow lines, of types one or more subdivisions apart. It may not be necessary to introduce a separate symbol to represent the character of the lines. If we consider all spectra with sharp or moderately sharp lines as normal and represent them in the ordinary way, then spectra with diffuse lines might be differentiated from the normal by the use of the same distinguishing letters and figures, but in different type, e.g., sloping or italic.

5. No other criterion necessary in a scheme of classification occurs to me.

Yours very respectfully,

J. S. Plaskett.

It will be seen from this report of the proceedings of these two meetings, how essential it is that the Observatory should be personally represented at such important meetings as these. The appointment of its representative, myself, on three committees dealing with far reaching international astronomical questions is an evidence I take it of the standing our Observatory has already attained by its work. I take it as a personal compliment, as well as a recognition of our scientific standing, to be associated with such men as Hale, Pickering, Campbell, Frost, Adams and Schlesinger of America, Dyson (Astronomer Royal), and Newall of England, and Kapteyn, Schwartzschild, Hartmann and others of Europe in the discussion of and co-operation in the three important and far-reaching problems above dealt with. I am satisfied that our work in the future will, at least, not lessen the estimation in which we are held, but will increase it. This will especially be the case if it were possible for us to take the great step forward of securing adequate telescopic power which has been already referred to.

It may be of interest to give a brief summary of the advantages accruing to the Observatory from my attendance as its representative at these two meetings. The indirect advantages have been already referred to previously, but there is the one direct advantage of the clear cut understanding arrived at in regard to the work on the solar rotation, which enables us to work most effectually along definitely laid down lines with no danger of duplication of work, and, at the same time, without in the least hampering originality of method or individuality of treatment. Furthermore, we are well assured by its inclusion in the work of the Solar Union of the great value and usefulness of the work when completed. Although it was not possible to arrange such a definite scheme of co-operation in stellar radial velocity investigation, the work of this committee is at least equally valuable and will undoubtedly also have most important results. So far as the question of spectral classification is concerned, the removal of the confusion at present existing in defining the spectral type of the stars is of great moment to the future progress of astronomy, and the representative committee at work on this question should be able to eventually formulate a permanent scheme.

To these direct advantages, to the advantage of the formal association of our Observatory with the greatest observatories of the world effected by my attendance at these meetings, is to be added the indirect benefit derived by me and, through me I hope, to my work by the inspiration received, and the enthusiasm renewed and increased from the association with fellow astronomers and the informal discussion of questions of mutual interest.

I desire here to express my thanks to you for the privilege and honour of attending these meetings as the representative of the Observatory.

Micrometric Work and Celestial Photography.

This work has been energetically carried on as in former years by Mr. Motherwell, and the detailed measures and descriptions are given by him in Appendix E. The unusually poor observing weather of the past year has, as in the radial velocity work, reduced the number of measures and also very seriously hindered effective photographic work on Halley's comet. The weather during May and June, when the comet was brightest, was very poor as indicated in the table given above of the number of observing nights and spectra obtained. In addition to this, on many of the nights which were otherwise fine, successful photography of the comet was prevented by moonlight, and the photographic record of this much heralded visitor is disappointingly small. It is, of course, true that the attachment of the camera to the equatorial telescope frequently hinders its use in photographing, but that difficulty will likely soon be overcome by the provision of a separate mounting and building which should enable a much greater quantity of work of improved quality to be done.

Since the refiguring of the 8-inch doublet it has performed very satisfactorily, and the 12-inch focus 3.5 Zeiss Tessar objective also gives good results. Its principal defect seems to lie in the diminution of the illumination towards the edges of the field, but this is inevitable in a lens of this type and is, of course, only especially noticeable when there is sky fog due to moonlight or to photographing, as is sometimes necessary in comet work, when the sun is not sufficiently far below the horizon.

Mechanical Work.

The two mechanicians, Messrs. Mackey and Lucas, have been employed during the past year chiefly in repair work and in various attachments and alterations to the meridian circle and auxiliary apparatus. In addition some minor alterations have been made in the details of the stellar spectroscopes; and the new reflecting prism and guide plate attachments to the solar spectrograph, described above, have been constructed. Considerable work has also been done on adjustable slides to be used in the standardizing building and other miscellaneous work.

On account of the illness of Mr. Mackey during the last four or five months of the year, the work got behind to some extent, but it is hoped that on his return we may be able to catch up with the arrears, although of course, it is likely, where there are so many instruments, many of them complicated and delicate, in constant use that more work will be always coming in. In addition, when we consider that desirable improvements in existing instruments are bound to suggest themselves to the intelligent and enthusiastic worker, it is evident that the workshop will continue to be as indispensable in the future as it has been in the past, and that there is no immediate prospect of any lack of work. We may congratulate ourselves on having two such skilful mechanicians to look after this important work. Mr. Dunn also has proved himself capable and satisfactory in looking after the carpentry work required.

General.

Before closing this report there are one or two other matters that may with advantage be briefly referred to.

The attendance at the Saturday evening open-nights with the telescope has not been as great as in former years, which is probably partly due to the fact that the weather has not been as favourable. During the time when Halley's comet was at

its brightest, however, there were record attendances of visitors who had to be convinced by ocular demonstration that a good naked eye comet is a much finer object by unaided vision than through any telescope. On every fine Saturday evening there is always a good attendance, although not the overcrowding that sometimes occurred previously. Our other method of stimulating interest in astronomy by means of the meetings of the Royal Astronomical Society has also fulfilled its purpose, although the attendance at some of the evening meetings has not been as large as we would like.

The afternoon meetings continue to prove very useful to the members of our own staff in disseminating knowledge of the various branches of the work and increasing interest and esprit de corps among the officers.

The papers contributed by this division to the Royal Astronomical Society during the period covered by this report are:—

1910.		
Apl. 21, 8 p.m.	Stellar Evolution and Theories of World Building	J. S. Plaskett.
May 3, 3 p.m.	Diffraction Grating of the Solar Spectroscope	R. E. DeLury.
Nov. 10, 3 p.m.	Irregularities in the Velocity Curves of some Stars with suggested explanations	W. E. Harper.
1911.		
Jan. 12, 3 p.m.	Notes from two Recent Astronomical Gatherings	J. S. Plaskett.
Feb. 23, 8 p.m.	Some Recent Interesting Developments in Astronomy	J. S. Plaskett.

At the Harvard meeting of the Astronomical and Astrophysical Society of America, the following paper was read:—

Probable Errors of Radial Velocity Determinations .... J. S. Plaskett.

At the meeting of the Royal Society, September, 1910, the following paper was read:—

Probable Errors of Radial Velocity Determinations .... J. S. Plaskett.

A list of papers written by members of this division and appearing in scientific publications during the year is given here.

1. The Orbit of η Boötis. Jourl. R. A. S. C., IV, 191, by W. E. Harper.
2. The Orbit of φ Persei. Jourl. R. A. S. C., IV, 195, by J. B. Cannon.
3. Halley's Comet. Notes and Photographs. Jourl. R A. S. C., IV, 224, by R. M. Motherwell.
4. Slit Width and Errors of Measurement in Radial Velocity Determinations. Jourl. R. A. S. C., IV, 345, by J. S. Plaskett.
5. The Astronomical and Astrophysical Society of America. Jourl. R. A. S. C., IV, 373, by J. S. Plaskett.
6. Double Star Measures. Jourl. R. A. S. C., IV, 447, by R. M. Motherwell.
7. Probable Errors of Radial Velocity Determinations, Astrophysical Jourl., XXXII, 230, by J. S. Plaskett.

8. The Collimation of the Correcting Lens. Astrophysical Journ., XXXII, 243, by J. S. Plaskett.
9. The Spectroscopic Binary ε Ursæ Minoris. Journ. R. A. S. C., IV, 462. by J. S. Plaskett.
10. Probable Errors of Radial Velocity Determinations. Trans. R. S. C., 1910, by J. S. Plaskett.
11. The Elements of 93 Leonis. Journ. R. A. S. C., IV, 452, by J. B. Cannon.
12. The Orbit of ν Orionis. Journ. R. A. S. C., V, 16, by W. E. Harper.
13. Changes in Focus produced by Plane Gratings. Journ. R. A. S. C., V, 26, by R. E. DeLury.
14. A Device for Guiding the Image from a Coelostat Telescope. Journ. R. A. S. C., V, 33, by R. E. DeLury.
15. The Spectroscopic Binary 7 Camelopardalis. Journ. R. A. S. C., V, 112, by W. E. Harper.

It will be noticed in the above list that No. 7 and 10 by myself have the same title, but the papers are not the same, the first one being more condensed and more in the nature of a summary of the work and results, while the second contains the full tabular material necessary in a complete treatment.

It is not right to close this report without expressing my gratitude for your unfailing interest in and encouragement of my work and for your readiness to meet any needs in the way of apparatus and material required or deemed useful in increasing its efficiency.

I have the honour to be, Sir,

Your obedient servant,

J. S. Plaskett.

APPENDIX A.

THE ORBIT OF ν ORIONIS. THE SPECTROSCOPIC BINARY 7 CAMELOPARDALIS. MEASURES OF o ANDROMEDAE AND ϵ CASSIOPEIAE. MISCELLANEOUS MEASURES.

W. E. Harfer, M.A.

The Orbit of ν Orionis.

The spectroscopic binary ν Orionis ($\alpha = 6^h\ 02^m$, $\delta = +14°\ 47'$, photographic magnitude about 4.2) was discovered* by Frost and Adams in 1903. The range in velocity of their three plates is approximately 70 km., which is in fact about the total range for the star. Their first observation was made at a fortunate time, it falling on the crest of the velocity curve which rises rapidly to a high positive value and falls again as rapidly. On this account this observation has been of material assistance in getting a more accurate value of the period than could be obtained from our own observations.

Work was commenced on the star here Nov. 11, 1907, and from that time to Dec. 30, 1910, one hundred and nineteen plates were secured. The first season's work gave the general form of the curve and during the three succeeding seasons efforts were made to obtain a full series of observations around periastron, where the curve, as previously mentioned, changes so rapidly. In this we have been only partially successful, as cloudy weather at each return to periastron prevented our obtaining all the observations desired. Nevertheless quite a number of reliable plates have been secured for this part of the curve, and the determination of the orbit has accordingly been proceeded with.

The spectrum is of type B2 and has numerous lines suitable for measurement. The hydrogen lines H_β, H_γ, H_δ and H_ϵ appear in the range of spectrum measured but the latter was scarcely ever measured, owing to the close proximity of the H line of calcium and consequent overlapping. The helium series $\lambda\lambda$ 4713, 4471, 4388, 4143, 4121, 4026 and 4009 are all measurable and these, excepting the first and last, were among the most frequently used. The magnesium λ 4481 and the calcium K λ 3933 are not so intense as either the helium or hydrogen series and do not appear in many of the spectra.

In view of the fact that a number of binaries have recently been discovered in which the calcium lines H and K give different velocities to the other lines, it may be noted here, that this is not the case with ν Orionis; the velocities of the K line agree with those of the other lines. Another good line is the carbon λ 4267. These were the lines most frequently measured but additional lines in a number of cases have been seen, and where these have been measured the resulting velocities were always in agreement with the lines most commonly used. Among these additional lines may be mentioned: $\lambda\lambda$ 4572, 4563, 4549, 4528, 4452, 4383, 4325, 4308, 4233, 4131 and 4128. There are also indications of the second series of hydrogen.

*Astrophysical Journal, Vol. XVIII., p. 386.

On the first one hundred plates all the lines that were at all measurable were used. When the results were plotted with the provisional period of 131·4 days there were many little irregularities in the curve; its appearance was that of a wavy line. As no indications of a second spectrum had been detected, even though a fine-grained plate had been used at the time of maximum positive velocity, it was difficult to account for this. It was thought that a possible cause might exist in the selection of lines varying from one plate to another. To decide this point and incidentally see if the wave-lengths used needed any arbitrary correction, a table was constructed of the residuals for each line from the mean of the plate. The result is contained in the accompanying table. Besides the twelve lines here listed there were various others which did not occur frequently enough to make mention of. The lines are arranged in order of frequency of measurement, the total number of plates being 100.

LINES MEASURED IN ν ORIONIS.

λ	Number of Times Measured.	Average Residual.	Corresponding Correction to Wave-length.
4340.634	97	−1 39 km.	+.020 t.m.
4388.100	94	−0.43 "	+.007 "
4471.676	94	+1.51 "	−.022 "
4143.928	86	−0.03 "	.000 "
4026.352	75	+1·67 "	−·022 "
4267·301	68	−2·45 "	+·035 "
4121·016	63	−0·11 "	+·002 "
4481·400	62	+1·95 "	−·029 "
4101·890	56	+0·99 "	−·014 "
4713·308	20	−1·48 "	
4861·527	19	+3·70 "	
3933·825	13	+1·40 "	

No corrections to wave-length are given for the last three as the observations were deemed too few in number and, furthermore, the ends of the spectrum may not always have been in focus thereby causing these residuals to be abnormal. The residuals in the above table are, in general, small relative to the probable error of a plate and while somewhat better accordance among the different lines on a plate would be secured by adopting an arbitrary set of wave-lengths based on the corrections, yet none of the residuals are so abnormal as to warrant such a procedure and accordingly the normal values have been retained. In subsequent measuring the first nine lines of the table were the only ones used, and the other hundred plates were recomputed using these lines alone so that the results ought, at least from a consideration of wave-length, to be consistent.

Plates from 1140 to 2257 were made with the single-prism spectrograph I L as first constructed, the dispersion at $H\gamma$ being 30.2 tenth-metres per millimetre. The balance were made with the new single-prism instrument, designated I, whose dispersion is 33.4 tenth-metres per millimetre at the same region. Plates 3369, 3847, 3865 and 3890 were made on Seed 23 plates, the remainder on Seed 27 emulsion. The four Seed 23 plates were made at times of high positive velocity to see if any trace of the second spectrum could be detected. No indications of such were seen.

Two plates have been omitted in the discussion, one, 2098, which gives a residual of 25 km. where the curve is well defined in the flat part. This is probably

owing to some instrumental error. The other case is that of plate 1315 which was taken immediately following plate 1314 under almost identical conditions and yet gives a decidedly greater positive velocity. The plate is somewhat underexposed, but there would seem to be some additional cause for the great difference in velocity, and as these observations occur around periastron this was one reason why a continuous series of plates at this phase was wished for. The intention is to make a few more plates next season at this critical place in the curve.

The observational data of the various plates is contained in the table following, the columns being self-explanatory. Then follows the measures of the plates in detail. The numbers of the plates are given in the top row and where these are followed by a capital, as is the case in some half-dozen instances, it means that that particular plate has been remeasured by another person. The abbreviations are:—

W = C. R. Westland.
P^1 = T. H. Parker.
C = J. B. Cannon.

P—Plaskett.
H—Harper.
P¹—Parker.
C—Cannon.

RECORD OF SPECTROGRAMS

Star	No. of Neg.	Camera	Plate	Date	Middle of Exposure G.M.T.	Duration	Hour Angle at End.	Temperature. Room Beg.	Room End.	Prism Box. Beg.	Prism Box. End.	Slit Width	Seeing	Observer	Remarks.
				1907.	h m	m	h m								
ν Orionis.	1140	I L	Seed 27	Nov. 11	22 16	67	3 04 W	− 3·0	− 2·5	5·5	5·5	·0014	Fair	H	Heavy fog.
" ..	1160	"	"	" 23	18 45	30	0 00	− 0·5	− 0·5	6·7	6·7	·0013	"	P	
" ..	1184	"	"	Dec. 4	22 00	40	4 05 W	−13·7	−14·0	0·8	0·7	·0015	Good	P	
" ..	1185	"	"	" "	22 47	45	4 55 W	−14·0	−14·7	0·7	0·7	"	"	P	
" ..	1197	"	"	" 28	17 30	35	1 05 W	− 7·0	− 7·8	3·1	3·1	·0016	"	P	
" ..	1198	"	"	" "	18 00	27	1 35 W	− 7·8	− 8·0	"	"	"	"	P	
				1908											
" ..	1217	"	"	Jan. 3	17 37	20	1 30 W	− 7·0	− 6·5	− 4·4	− 4·4	·0013	....	P	Cloudy 10ᵐ
" ..	1223	"	"	" 13	19 20	30	4 00 W	−13·2	−15·5	− 0·8	− 1·3	"	....	P	Control off.
" ..	1224	"	"	" "	20 05	30	4 45 W	−15·5	−16·0	− 1·3	− 1·3	"	....	P	
" ..	1229	"	"	" 14	20 14	38	5 00 W	−16·0	−17·0	− 5·4	− 5·3	"	Hazy	H	
" ..	1235	"	"	" 16	13 00	25	2 13 E	−13·5	−13·5	− 6·0	− 6·0	"	Poor	P-H	
" ..	1250	"	"	" 20	17 06	33	2 13 W	− 6·0	− 7·3	− 6·9	− 6·9	"	....	P-H	
" ..	1251	"	"	" "	17 39	30	2 45 W	− 7·3	− 8·0	"	"	"	....	H-P	
" ..	1261	"	"	" 22	18 41	38	4 00 W	−10·2	− 9·8	0·1	0·0	"	....	P	Unsteady
" ..	1273	"	"	" 24	14 05	30	0 30 E	−15·6	−16·0	− 9·0	− 9·0	"	....	P	
" ..	1282	"	"	" 27	13 49	25	0 40 E	−13·3	−14·6	−11·1	−11·1	"	Good	P	
" ..	1302	"	"	" 29	15 39	30	1 20 W	−22·3	−22·5	− 8·7	− 8·7	"	....	H	Unsteady.
" ..	1303	"	"	" "	16 06	22	1 43 W	−22·5	−23·0	− 8·7	− 8·6	"	Fair	H	
" ..	1314	"	"	Feb. 3	14 48	23	0 45 W	−19·5	−19·5	− 7·7	− 7·8	"	"	H	
" ..	1315	"	"	" "	15 47	26	1 40 W	−19·5	−20·0	− 7·8	− 7·8	"	Only Fair	H	
" ..	1320	"	"	" 8	16 47	25	3 05 W	−17·5	−18·0	−10·2	−10·2	"	....	P	
" ..	1325	"	"	" 17	15 30	24	2 23 W	−14·0	−14·0	− 2·3	− 2·4	"	Fair	H	
" ..	1326	"	"	" "	15 56	27	2 50 W	−14·0	−14·5	− 2·4	− 2·5	"	"	H	
" ..	1335	"	"	" 20	13 36	18	0 30 W	− 7·1	− 7·5	− 1·1	− 1·1	·0015	Good	P	
" ..	1337	"	"	" 21	16 40	30	3 50 W	− 4·0	− 4·4	0·6	0·5	·0013	Fair	P	
" ..	1348	"	"	" 22	17 20	50	4 45 W	−13·5	−15·0	− 4·6	− 4·6	"	"	P	Spectrum wide.
" ..	1352	"	"	" 24	14 50	20	2 10 W	−11·8	−12·0	− 2·1	− 2·1	"	....	P	
" ..	1377	"	"	Mar. 4	16 15	46	4 21 W	− 7·5	− 8·5	0·3	0·6	"	Fair	H	Off 10ᵐ
" ..	1385	"	"	" 9	16 17	35	4 35 W	− 9·5	−10·8	0·3	0·4	"	Good	P	
" ..	1396	"	"	" 16	12 48	24	1 30 W	− 5·8	− 6·0	2·4	2·4	·0014	Fair	P	
" ..	1485	"	"	Apr. 15	13 22	40	4 15 W	2·5	2·0	8·2	8·0	·0015	....	H	

P—Plaskett.
H—Harper.
P¹—Parker.
C—Cannon.

RECORD OF SPECTROGRAMS—(Continued).

Star.	No. of Neg.	Camera	Plate.	Date.	Middle of Exposure. G.M.T.	Duration	Hour Angle at End.	Temperature. Room. Beg.	Temperature. Room. End.	Temperature. Prism Box. Beg.	Temperature. Prism Box. End.	Slit Width.	Seeing.	Observer	Remarks.
					h m	m	h m								
				1908.											
ν Orionis.	1497	I L	Seed 27	Apr. 17	12 50	40	3 55 W	8·6	7·0	11·0	10·9	·0015	Fair	P	
" ..	1503	"	"	" 22	13 11	48	4 32 W	10·5	9·0	14·0	14·0	"	"	H	
" ..	1916	"	"	Oct. 2	22 35	19	0 44 E	3·3	3·3	13·0	13·0	"	....	C	
" ..	1943	"	"	" 19	23 00	65	0 20 W	5·0	5·0	16·2	16·2	"	Very poor	H	
" ..	2009	"	"	Dec. 7	20 23	40	2 45 W	− 9·5	− 9·5	− 0·8	− 0·8	"	....	H	Windy.
" ..	2010	"	"	" "	21 00	31	3 15 W	"	"	"	"	"	Hazy	H	
" ..	2019	"	"	" 9	20 54	32	3 20 W	−20·0	−20·0	− 2·0	− 2·0	"	Fair	C	
" ..	2020	"	"	" "	21 33	43	4 03 W	"	"	− 2·0	− 2·4	"	"	C	
" ..	2025	"	"	" 10	16 02	55	1 15 E	−17·5	−17·5	− 7·9	− 7·8	"	....	P¹	Cloudy.
" ..	2034	"	"	" 16	19 42	45	2 42 W	−10·5	−10·8	2·8	2·8	"	Good	C	
" ..	2035	"	"	" "	20 28	44	3 27 W	−10·8	−11·6	2·8	2·7	"	"	C	
" ..	2061	"	"	" 21	20 21	38	3 35 W	−13·8	−14·5	− 2·0	− 2·0	"	"	C	
				1909											
" ..	2133	"	"	Jan. 13	18 54	72	3 55 W	−15·0	−16·4	−12·2	−12·2	·0016	Hazy	C–H	Off 15ᵐ
" ..	2147	"	"	" 15	18 49	45	3 50 W	−17·6	−18·5	− 5·5	− 5·5	"	Good	P¹	Off 15ᵐ
" ..	2230	"	"	Feb. 3	16 53	67	3 17 W	−12·0	−13·5	− 3·7	− 3·9	"	"	H	Off 20ᵐ
" ..	2257	"	"	" 8	17 14	58	3 55 W	−16·6	−16·0	− 5·6	− 5·3	"	....	P¹	
" ..	2339	I	"	Mar. 8	16 54	42	5 15 W	− 4·0	− 5·4	3·2	3·0	·002	Good	P¹	
" ..	2380	"	"	" 15	16 36	42	5 30 W	− 4·0	− 4·2	0·5	− 0·4	"	Fair	P¹	Changed relay cells.
" ..	2410	"	"	" 22	16 10	20	5 25 W	− 0·2	0·0	5·5	5·5	"	Hazy	P¹	
" ..	2428	"	"	" 23	15 47	54	5 15 W	0·5	0·0	7·6	7·6	"	....	C	Off 10ᵐ
" ..	2446	"	"	" 31	15 00	50	4 55 W	5·0	6·0	10·0	10·0	"	....	H	
" ..	2524	"	"	Apr. 28	13 18	60	5 06 W	3·0	3·0	8·9	8·9	"	Good	H	
" ..	2781	"	"	Sept. 7	21 27	46	2 00 E	8·5	8·0	11·6	11·7	"	5	P¹	"Seeing" in future rated from 0 to 5.
" ..	2808	"	"	" 20	21 10	40	1 35 E	11·6	11·6	20·0	20·0	"	5	C	
" ..	2809	"	"	" "	21 53	43	0 54 E	11·6	11·5	"	"	"	5	C	
" ..	2831	"	"	" 28	21 16	40	1 00 E	7·5	6·6	10·8	10·8	"	4-5	C	
" ..	2832	"	"	" "	21 58	43	0 15 E	6·6	6·3	10·8	10·7	"	4	C	
" ..	2844	"	"	Oct. 4	19 29	41	2 07 E	11·0	11·0	22·9	22·7	"	5	H	
" ..	2876	"	"	" 8	20 17	33	1 15 E	12·7	12·1	22·7	22·7	"	5	P¹	
" ..	2877	"	"	" "	20 52	35	0 45 E	12·1	11·8	"	"	"	5	P¹	

"	..	2898	"	"	"	19	22	47	25	1 46 W	2·0	1·6	7·9	7·9	"	5	C	
"	..	2907	"	"	"	20	20	04	82	0 05 W	− 0·1	− 0·2	6·8	6·8	"	1–4–5	C	
"	..	2908	"	"	"	"	21	36	39	0 45 W	− 0·2	− 0·2	"	"	"	5	C	
"	..	2927	"	"	"	29	20	45	50	0 40 W	− 1·1	− 1·5	5·5	5·6	·0017	4	P1	
"	..	2928	"	"	"	"	21	36	48	1 25 W	− 1·5	− 1·8	5·6	5·6	"	5	P1	
"	..	2939	"	"	Nov.	8	22	50	50	3 20 W	1·5	1·5	5·7	5·7	·002	5	H	
"	..	2942	"	"	"	9	21	10	40	1 40 W	− 0·5	− 1·2	0·6	0·4	"	2–0	C	
"	..	2948	"	"	"	12	18	29	51	0 45 E	7·5	7·1	15·6	15·6	"	5	P1	
"	..	2949	"	"	"	"	19	33	73	0 25 W	7·1	6·2	"	"	"	5–1–3	P1	
"	..	2957	"	"	"	15	19	39	48	0 40 W	2·0	1·5	15·7	15·8	"	5	P1	
"	..	2958	"	"	"	"	20	30	50	1 30 W	1·5	0·6	15·8	15·9	"	5	P1	
"	..	2969	"	"	"	23	18	42	45	0 10 W	− 7·5	− 8·0	4·1	3·6	"	5	H	
"	..	2970	"	Seed 23	"	"	19	41	71	1 22 W	− 8·0	− 9·0	3·6	3·6	"	5	H	
"	..	2977	"	Seed 27	"	26	15	45	44	2 35 E	1·0	1·0	6·5	6·4	"	5	H	
"	..	2978	"	"	"	"	16	40	43	1 40 E	1·0	0·5	6·4	6·4	"	5	H	
"	..	2986	"	"	"	30	21	00	40	2 55 W	− 3·8	− 3·5	4·2	4·2	"	....	C	Clouds after 10m.
"	..	2998	"	"	Dec.	1	16	17	35	1 50 E	0·0	− 0·5	6·6	6·6	"	4	P	
"	..	2999	"	"	"	"	16	50	29	1 20 E	− 0·5	− 0·9	"	"	"	4	P	
					1910													
"	..	3094	"	"	Jan.	10	15	20	55	0 00	−15·0	−16·5	− 3·8	− 3·6	"	2–0	H	
"	..	3099	"	"	"	12	14	26	37	1 05 E	− 8·0	− 8·5	− 3·2	− 3·2	"	4–0	P1	
"	..	3100	"	"	"	13	16	10	40	0 55 W	− 7·0	− 9·0	− 0·2	− 0·2	"	3–4	P	
"	..	3101	"	"	"	"	17	00	56	1 50 W	− 9·0	−10·2	"	"	"	2–3–4	P	
"	..	3143	"	"	"	25	19	02	45	4 35 W	− 6·8	− 7·1	− 3·2	− 3·3	"	4–3	P	
"	..	3159	"	"	"	31	15	15	40	1 10 W	− 8·3	− 8·8	1·7	1·7	"	4–5	C	
"	..	3160	"	"	"	"	16	03	54	2 15 W	− 8·8	− 9·0	1·7	1·8	"	4–5	C	Off 15m
"	..	3203	"	"	Feb.	21	14	48	40	2 05 W	− 4·0	− 4·6	3·2	3·0	"	4–5	C	
"	..	3319	"	"	Mar.	11	13	34	42	2 03 W	2·0	1·5	6·0	6·0	"	5	H	
"	..	3320	"	"	"	"	14	18	43	2 50 W	1·5	1·0	"	"	"	5	H	
"	..	3351	"	"	"	16	14	30	50	3 25 W	− 6·0	− 7·5	4·2	4·0	"	4	P1	Windy.
"	..	3352	"	"	"	"	15	21	48	4 15 W	− 7·5	− 9·0	4·0	4·0	"	4	P1	
"	..	3356	"	"	"	23	15	07	66	4 30 W	3·5	2·6	9·0	9·0	"	1–0–3	P1	
"	..	3361	"	"	"	28	14	05	40	3 45 W	13·8	12·7	19·0	19·8	"	4	C	
"	..	3362	"	"	"	"	14	48	44	4 30 W	12·7	11·6	19·8	19·5	"	4	C	
"	..	3369	"	Seed 23	Apr.	1	13	12	100	3 32 W	10·0	8·5	14·5	14·3	"	2	H	
"	..	3370	"	Seed 27	"	2	12	35	40	2 30 W	11·8	11·0	15·2	15·2	"	4	P	
"	..	3373	"	"	"	3	12	30	45	2 30 W	8·5	7·5	10·4	10·3	"	4	H	
"	..	3374	"	"	"	"	13	17	45	3 18 W	7·5	6·7	10·3	10·1	"	5	H	
"	..	3390	"	"	"	13	13	40	60	4 30 W	8·5	7·6	10·0	10·0	"	3	P1	
"	..	3401	"	"	"	22	13	11	55	4 33 W	18·0	15·5	19·2	18·8	"	3–4	H	Windy.
"	..	3404	"	"	"	25	13	25	50	4 55 W	16·7	16·1	17·3	17·2	"	2	C	
"	..	3653	"	"	Sept.	14	22	01	30	1 15 E	8·8	8·6	16·7	16·7	"	4–5	C	
"	..	3670	"	"	"	16	21	00	40	2 00 E	10·2	10·3	20·2	20·0	"	4	P1	
"	..	3671	"	"	"	"	21	46	48	1 10 E	10·3	10·5	20·0	20·0	"	4–3	P1	
"	..	3688	"	"	"	21	21	47	46	0 55 E	4·8	4·8	16·5	16·7	"	4–5	C	

P—Plaskett.
H—Harper.
P[1]—Parker.
C—Cannon.

RECORD OF SPECTROGRAMS—(Concluded).

Star.	No. of Neg.	Camera	Plate.	Date.	Middle of Exposure G.M.T.	Duration	Hour Angle at End.	Temperature.				Slit Width.	Seeing.	Observer	Remarks.
								Room.		Prism Box.					
								Beg.	End.	Beg.	End.				
				1910	h m	m	h m								
ν Orionis.	3703	I	Seed 27	Sept. 28	21 05	50	1 06 E	7·5	6·6	17·8	17·9	·002	3–4	C	
" ..	3704	"	"	" "	21 56	50	0 17 E	6·6	6·4	17·9	"	"	3	C	
" ..	3822	"	"	Dec. 5	20 47	45	3 00 W	−12·3	−13·0	− 2·4	− 2·4	"	3	H	
" ..	3823	"	"	" "	21 40	56	4 05 W	−13·0	−13·5	− 2·4	− 2·4	"	3	H	
" ..	3828	"	"	" 6	21 22	65	3 50 W	−16·7	−17·0	− 5·6	− 5·6	"	4–2	P[1]	
" ..	3837	"	"	" 8	17 07	45	0 30 E	−13·0	−15·0	0·3	0·2	"	4–5	H	
" ..	3847	"	Seed 23	" 9	19 47	86	2 40 W	−20·0	−20·8	− 8·1	− 9·0	"	4–5	P[1]	
" ..	3865	"	"	" 12	21 29	98	4 38 W	−12·5	−14·5	− 4·7	− 4·9	"	3–4–5	H	
" ..	3878	"	Seed 27	" 16	16 39	55	0 20 E	−16·0	−16·0	− 7·8	− 7·8	"	3–4	H	
" ..	3879	"	"	" "	17 33	50	0 35 W	"	−17·8	"	− 7·7	"	4	H-P[1]	
" ..	3890	"	Seed 23	" 21	18 01	90	1 39 W	−16·6	−17·0	− 0·4	− 1·0	"	5	P[1]-H	
" ..	3908	"	Seed 27	" 30	18 11	46	2 02 W	−27·5	−26·0	− 8·2	− 8·3	"	5	H	
" ..	3909	"	"	" "	18 58	45	2 50 W	−26·0	−27·2	− 8·3	− 8·5	"	5	H	

DETAILED MEASURES OF ν ORIONIS.

λ	1140W.		1140.		1140.		1160W.		1160		1160.		1184W.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481			− 7·1	½					−24·4	½	+ 0·8	¼		
4471	−32·9	½	−35·1	1	−39·1	¼	− 1·9	1½	0·0	1			−20·7	1
4388	26·6	1	−25·5	1	−22·7	½	+ 1·2	1	− 7·2	1½	−13·8	½		
4340	10·7	1	− 9·5	1½	−16·8	½	+ 0·6	1	+10·0	1	+ 0·8	½	+13·0	½
4267			−30·9	½					+14·1	¾				
4143									+20·2	½	− 2·7	½		
4121			− 7·3	½	+ 1·1	½			+ 3·0	1	− 4·0	½		
4101	−13·0	½	+ 5·0	1	+ 4·4	1	− 5·0	½	− 7·2	¾	− 8·1	¼	+ 2·6	½
4026			−27·1	½			+11·6	1	− 9·8	1	− 9·8	¼	+ 2·7	1
Weighted Mean	−20·08		−15·00		− 8·95		+ 1·61		− 0·56		− 4·95		− 3·40	
V_a	+19·43		+19·43		+19·43		+14·45		+14·45		+14·45		+ 9·17	
V_d	− ·19		− ·19		− ·19		+ ·02		+ ·02		+ ·02		− ·26	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Vel...	− 1·1		+ 4·0		+10·0		+15·8		+13·6		+ 9·2		+ 5·2	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	1184.		1185W.		1185.		1197.		1198.		1217.		1223.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481					−19·8	½								
4471	−33·1	1	+ 8·2	1	+ 1·3	½	+ 5·4	1	+ 4·3	1	+32·7	1¼	+36·3	3
4388	−19·7	1	−20·5	½	− 9·1	¾	+17·9	½	− 0·8	½	22·5	2	44·8	1
4340	+ 9·9	1½	− 9·5	1	− 2·7	¾	+13·7	2	+ 8·0	2	32·3	2	38·2	1½
4267					+12·9	¼								
4143					− 1·6	½	+21·0	1	+45·7	1	20·4	2	20·5	½
4121					− 1·5	1					35·8	½		
4101	+ 9·5	1	−12·5	½			+39·6	½	+ 9·3	1	22·3	1½	24·2	1
4026	+ 1·3	1	− 2·7	1	− 5·3	1¼	+11·2	½	+37·4	1½	+14·8	1½	+37·6	1½
Weighted Mean	− 4·94		− 5·12		− 4·34		+16·03		+18·72		+24·64		+35·51	
V_a	+ 9·17		+ 9·17		+ 9·17		− 3·12		− 3·12		− 6·12		−11·25	
V_d	− ·26		− ·29		− ·29		− ·06		− ·12		− ·12		− ·20	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Vel...	+ 3·7		+ 3·5		+ 4·3		+12·6		+15·2		+18·1		+23·8	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	1224.		1229.		1235.		1250.		1251.		1261.		1273.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	......	...	......	...	+32·8	½	+52·7	½	......	...	+39·5	½	+68·4	½
4471	+43·5	1½	+47·2	½	34·4	2	62·3	2½	+60·8	½	61·8	3	73·6	2
4388	47·3	1½	32·4	1	32·6	1	49·1	1	45·5	½	63·7	1½	61·6	1½
4340	32·4	1	57·8	½	32·9	1	51·9	2	57·2	½	38·3	1½	44·8	2
4267	......	...	......	...	......	...	......	...	45·0	1	......	...	55·8	1
4143	48·1	½	27·2	½	54·8	½	53·0	1	49·7	½	......	...	61·2	1½
4121	+39·2	½	......	...	48·2	1	43·1	1½	26·8	½	52·3	½	53·0	1½
4101	......	...	......	...	......	...	26·8	½	61·9	½	39·5	½	47·9	½
4026	......	...	+45·3	½	+19·9	1	+64·6	½	+64·6	¾	+49·8	1	+41·8	1
Weighted Mean	+42·45		+40·38		+35·16		+52·51		+51·43		+53·40		+57·94	
V_a	−11·25		−11·75		−12·56		−14·50		−14·50		−15·43		−16·30	
V_d	− ·28		− ·28		+ ·19		− ·15		− ·18		− ·26		+ ·06	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+30·6		+28·1		+22·5		+37·6		+36·5		+37·4		+41·4	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	1282.		1282.		1302.		1303.		1314.		1314.		1315.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt	Vel.	Wt.	Vel.	Wt
4481	+80·6	½	......	...	+67·1	1	+75·6	1½	......	...	......	...	......	...
4471	72·0	1½	+66·0	½	69·5	1½	69·5	1½	+85·8	2	+83·7	1½	+170·5	1
4388	82·1	1	78·1	¾	67·0	1	75·4	1½	90·7	½	98·5	¾	167·4	¼
4340	59·6	2	60·9	¾	72·2	1½	86·9	1½	111·7	1	119·5	1	166·7	1½
4267	65·5	1	79·1	½	......	...	85·7	1	71·0	½	81·3	½	......	...
4143	78·7	½	56·0	¼	65·5	1½	69·6	1	74·5	½	79·6	½	......	...
4121	83·2	1	73·9	½	64·0	1	101·0	½	......	...	......	...	......	...
4101	+75·9	½	+60·2	½	83·4	1½	82·7	1	84·5	½	87·4	½	+153·0	½
4026	......	...	......	...	+62·2	1	+82·2	½	+117·2	½	118·3	¾	......	...
Weighted Mean	+71·95		+68·77		+69·62		+79·07		+91·32		+96·69		+165·83	
V_a	−17·51		−17·51		−18·30		−18·30		−20·30		−20·30		− 20·30	
V_d	+ ·09		+ ·09		− ·09		− ·12		− ·04		− ·04		− ·12	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+54·2		+51·1		+51·0		+60·4		+70·7		+76·1		+145·0	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	1315.		1315.		1315.		1320.		1325.		1325P[1]		1326.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481..........	....	...	....	...	....	...	+86·3	½	+73·7	½	+50·1	1	....	....
4471..........	+179·2	1	+184·4	½	+180·8	¼	69·1	2	45·7	1½	71·5	1	....	....
4388..........	....	...	180·0	⅛	114·4	¼	85·9	2	62·7	2	73·5	1	+31·9	1½
4340..........	130·8	½	128·7	¾	107·1	½	74·4	2	53·2	2	77·1	1	42·8	1½
4267..........	....	...	....	...	....	...	77·1	½	45·9	½	....	....	....	....
4143..........	....	...	....	...	....	...	72·2	1	44·4	1	40·8	1	32·1	1
4121..........	....	...	....	...	....	...	74·2	1	59·7	1	47·3	1	34·4	1
4101..........	154·1	¼	162·4	½	+137·6	½	50·6	½	48·9	1	44·8	1	43·9	1
4026..........	+136·3	¼	+130·2	¼	....	...	+81·7	2	+64·1	1	+68·8	1	+53·6	1½
Weighted Mean......	+158·61		+152·94		+130·78		+76·14		+50·75		+59·24		+40·39	
V_a	− 20·30		− 20·30		− 20·30		−22·16		−24·95		−24·95		−24·95	
V_d	− ·12		− ·12		− ·12		− ·22		− ·17		− ·17		− ·19	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	+138·0		+132·0		+110·0		+53·5		+25·3		+33·8		+15·0	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	1326.		1335.		1335P[1]		1337.		1348.		1352.		1377.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481..........	....	....	+52·0	1	+52·7	1	+52·5	1	+30·5	1½	+62·6	1	....	....
4471..........	....	....	63·1	2	64·9	1	59·0	1½	64·3	1	60·2	1½	+41·6	1
4388..........	....	....	41·9	1	47·6	1	59·9	1½	65·7	1	44·2	1½	43·3	1
4340..........	+55·3	1	26·8	1½	27·1	1	52·9	1½	70·2	2	61·2	2	30·9	½
4267..........	....	....	55·9	1½	60·3	1	74·9	1	58·0	½	47·4	½	....	....
4143..........	33·2	1¼	48·6	1	46·1	1	49·7	1	76·1	1	40·8	½	64·2	1
4121..........	26·6	¾	65·7	½	....	....	....	....	44·9	1	59·7	½	42·7	½
4101..........	+41·1	1	49·5	1½	49·7	1	48·9	1½	55·8	½	56·7	1¼	64·5	1
4026..........	....	....	+37·8	1	+37·5	1	+62·3	1½	+32·3	1	+39·1	1	+50·5	1
Weighted Mean......	+39·65		+48·88		+48·24		+57·30		+55·40		+53·90		+50·17	
V_a	−24·95		−25·74		−25·74		−26·01		−26·28		−26·82		−28·34	
V_d	− ·19		− ·04		− ·04		− ·25		− ·29		− ·15		− ·15	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	+14·2		+22·8		+22·2		+30·8		+28·5		+26·7		+21·4	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	1385.		1396.		1485.		1497.		1503.		1916P[1]		1916.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481..........	+36·1	1½	+47·8	½	....	....	+22·6	½	....	....	−15·3	1	−17·4	½
4471..........	42·0	1½	41·0	3	....	....	32·5	1	+26·9	1½	+14·6	1	− 8·1	1
4388..........	44·3	2	50·8	2	+52·9	¾	42·4	1½	....	....	+ 9·1	½	− 6·9	½
4340..........	54·6	1½	32·4	2	34·4	½	35·6	1½	....	....	− 1·2	½	− 6·7	½
4267..........	42·7	1	57·4	2	+37·5	¼	49·4	½	+23·7	1½	....	....	....	....
4143..........	34·5	1	25·0	1	....	....	34·1	1½	....	....	....	....	+ 8·6	¼
4121..........	28·0	½	46·0	1½	....	....	....	....	....	....	....	....	+ 1·2	¼
4101..........	29·0	1	48·0	1½	....	....	36·5	2	....	....	−28·4	½	....	....
4026..........	+47·8	1½	+44·8	2	....	....	+33·7	1½	....	....	−23·5	½	−19·7	1
Weighted Mean......	+41·70		+44·11		+44·20		+36·02		+25·30		− 5·67		−10·24	
V_a	−28·95		−29·43		−26·72		−26·23		−25·03		+28·95		+28·95	
V_d	− ·29		− ·11		− ·28		− ·25		− ·28		+ ·09		+ ·09	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	+12·2		+14·3		+16·9		+10·3		−0·03		+23·0		+18·0	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	1943.		2009P[1]		2009.		2010.		2019.		2020·		2025.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481..........	....	....	−26·0	1	....	....	− 3·2	½	....	....	....	....	−23·5	½
4471..........	....	....	− 9·4	1	+ 4·6	1	− 6·8	½	+ 1·2	1	− 2·0	1	− 0·2	1½
4388..........	+50·2	¾	− 6·5	½	−11·0	1	....	....	+ 0·2	1	....	....	− 6·9	1
4340..........	45·2	¼	+15·9	1	− 2·6	1	....	....	−15·7	½	33·8	¼	+ 3·1	1½
4267..........	....	....	+ 0·4	½	+ 3·4	1	....	....	....	....	10·7	¼	−12·6	2
4143..........	....	....	+17·3	1	± 0·0	1	....	....	− 0·5	½	− 0·4	½	−19·7	1
4121..........	+24·7	1	....	....	+17·1	½	....	....	....	....	....	....	....	....
4101..........	....	....	+24·8	½	+ 8·0	½	....	....	....	....	....	....	−24·8	½
4026..........	....	....	− 3·3	1	− 6·7	1	....	....	....	....	....	....	−16·3	1
Weighted Mean.......	+36·81		+ 0·60		+0·03		− 5·00		− 2·25		− 5·51		−9·78	
V_a	+26·31		+ 7·31		+7·32		+ 7·32		+ 6·36		+ 6·36		+5·89	
V_d	+ ·03		− ·19		− ·19		− ·22		− ·22		− ·26		+ ·14	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	+63·0		+ 7·4		+6·9		+ 2·0		+ 3·6		+ 0·3		−4·0	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	2025.		2034.		2034C.		2035.		2035.		2061.		2061.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481			− 1·6	½	− 3·9	½	−15·7	½			−17·9	1	− 8·3	½
4471	−16·8	½	+ 9·5	1¼	− 8·7	1	−15·3	½	−24·3	½	− 4·0	1	− 8·8	¾
4388	+ 2·1	½	+ 5·7	¾	− 4·2	½	± 0·0	½	− 0·8	¾	+15·4	1	+20·4	1
4340	± 0·0	½	+19·7	1	+19·3	1	− 1·4	½	− 9·3	½	− 0·8	½		
4267	− 0·8	½	+ 6·8	½	+19·6	⅛			− 9·0	¾	+15·4	½	+11·5	½
4143	−14·7	½	− 0·4	½	−16·0	⅛	+ 8·8	½	+ 3·7	½	−19·6	1	− 8·8	1
4121			+12·9	1	+ 8·4	¼			+ 2·5	½			+ 9·8	¾
4101											+21·6	½		
4026	−18·2	½	+ 7·8	1	+ 9·9	1					+14·1	1	+10·2	1
Weighted Mean	−8·14		+9·43		+4·22		−4·16		−6·02		+0·94		+4·39	
V_a	+5·89		+2·71		+2·71		+2·71		+2·71		+ ·09		+ ·09	
V_d	+ ·14		− ·18		− ·18		− ·22		− ·22		− ·23		− ·23	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−2·4		+11·3		+6·5		−1·9		−3·8		+0·5		+4·0	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	2133.		2147.		2230.		2257.		2339.		2380.		2410.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	+19·0	1			+27·7	½	+54·7	½	+81·4	½	+75·1	¼	+38·5	1
4471	25·4	1½	+17·1	1	19·5	1½	35·8	2	74·4	1	69·2	1½	40·0	½
4388	23·6	2	+ 7·7	½	21·3	1	38·5	1½	91·2	2	61·4	1	53·3	½
4340	24·1	1½	+35·0	½	18·6	1½	55·2	½	84·3	1	72·1	¾	76·2	½
4267					34·9	1	55·4	½	79·3	2	75·1	½	+77·7	1½
4143	22·3	1¼			43·8	1	57·2	½	80·8	1½	60·0	½		
4121	19·4	1			31·0	1			+68·4	1				
4101	26·4	½			31·7	½	+36·3	½						
4026	+17·1	1			+45·9	1					+47·5	½		
Weighted Mean	+22·36		+19·25		+32·97		+43·12		+81·11		+65·87		+59·94	
V_a	−11·60		−12·54		−20·64		−21·89		−28·81		−29·38		−29·38	
V_d	− ·23		− ·25		− ·20		− ·25		− ·30		− ·31		− ·31	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+10·3		+ 6·2		+11·8		+20·7		+51·7		+35·9		+30·0	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	2428.		2446.		2524.		2781.		2808.		2809.		2831.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	+53·9	1	+37·4	¾	......	....	− 9·8	½	−23·6	½	−22·9	½	......	....
4471	67·1	1½	32·3	¾	+33·1	2	13·3	1½	16·2	1½	19·0	1½	− 3·9	1
4388	55·8	1½	60·7	1	54·7	1½	7·3	1½	20·4	1	23·5	1	22·1	1½
4340	41·3	1½	50·4	1½	39·3	2	6·9	½	34·0	½	21·3	1½	22·7	1
4267	67·9	2	66·7	2	31·8	1½	......	....	......	....	11·8	½	31·1	1½
4143	45·8	½	52·4	1	35·9	1	5·6	1½	20·3	½	44·5	½	6·1	½
4121	70·6	½	61·6	1½	......	....	26·2	1	−14·9	½	14·2	½	30·1	¾
4101	......	....	68·3	1	20·5	½	−26·6	1½	......	....	......	....	10·9	¾
4026	+64·2	1	+38·0	1½	+26·8	1	......	....	......	....	−35·3	½	−21·6	1
Weighted Mean	+61·01		+53·83		+36·55		−14·22		−20·25		−22·04		−20·23	
V_a	−29·49		−29·05		−23·40		+28·28		+29·39		+29·39		+29·22	
V_d	− ·30		− ·29		− ·30		+ ·17		+ ·15		+ ·10		+ ·11	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+30·9		+24·2		+12·6		+14·0		+ 9·0		+ 7·1		+ 8·8	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	2832.		2844.		2876.		2877.		2898.		2907.		2908.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	......	....	−31·8	¾	......	....	−28·4	1	− 8·4	1	−34·3	½	− 6·4	1
4471	− 4·6	1	28·1	1	−31·6	1½	50·6	1	3·9	1½	−40·1	½	6·1	1
4388	26·4	1	26·9	1	22·6	1	24·1	1	0·2	½	−23·1	1½	1·2	1½
4340	21·2	1	24·2	1½	9·2	1	22·3	1	7·3	1	−27·0	1½	6·9	2
4267	......	....	10·9	1½	14·8	½	23·2	1	......	....	+ 1·1	1	0·4	1
4143	1·8	½	11·4	1	......	....	21·7	½	0·0	1	−10·0	1	7·1	1
4121	23·5	½	38·0	½	28·7	1	20·3	1	......	....	+ 3·5	1	......	....
4101	21·6	¾	−33·0	½	......	....	......	....	......	....	− 1·7	½	3·6	1
4026	−26·0	1¼	......	....	−30·4	1	−36·0	½	−16·3	1	−20·7	1	−13·0	1
Weighted Mean	−18·92		−23·08		−24·27		−28·23		− 6·32		−16·39		− 5·49	
V_a	+29·22		+28·74		+28·35		+28·35		+26·35		+26·17		+26·17	
V_d	+ ·04		+ ·19		+ ·12		+ ·07		− ·12		+ ·02		+ ·04	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+10·1		+ 5·6		+ 3·9		+ 0·1		+19·6		+ 9·5		+20·4	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	2927.		2928.		2939.		2942.		2948.		2949.		2957.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	......	....	+ 0·4	1½	+32·9	½	+39·1	¼	......	....	+23·7	1½	+26·5	¾
4471	−10·0	2	− 1·0	1	14·8	1¾	11·7	½	+27·0	1½	43·8	1½	49·7	1
4388	− 4·1	1½	+ 2·4	1	14·0	1	15·7	½	54·3	1½	12·6	1½	36·4	1
4340	− 9·0	1½	+ 2·3	1½	18·9	1	46·6	¼	47·2	1½	44·4	1½	66·0	1
4267	−23·8	1	......	..	19·1	1	......	....	41·4	1	30·1	1½	42·8	¾
4143	−11·4	1½	− 5·0	1	19·9	1	+37·7	½	37·0	1	25·8	1	60·0	1
4121	+ 4·9	1	−14·9	1½	10·4	¾	......	....	22·4	1	30·1	1½	52·9	½
4101	−12·2	1	− 4·5	1	29·8	½	......	....	24·9	½	22·1	½	46·3	¾
4026	+ 3·6	1½	+ 2·8	1	+28·0	¼	......	....	+22·5	1½	+33·3	1½	+25·4	¼
Weighted Mean	− 7·50		− 2·48		+18·57		+27·00		+35·76		+30·32		+47·37	
V_a	+23·78		+23·78		+20·38		+20·04		+18·91		+18·91		+17·71	
V_d	− ·02		− ·09		− ·22		− ·11		+ ·10		+ ·02		− ·02	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+16·0		+20·9		+38·4		+47·0		+54·5		+49·0		+64·8	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	2958.		3404		2970.		2977.		2978.		2986.		2998.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	+33·5	½	+50·7	1¼	+60·3	¾	+39·5	½	+38·2	¾	......	....	+7·9	½
4471	31·2	1½	48·9	1¼	45·5	1½	......	....	46·6	1	+52·4	½	3·7	¾
4388	35·1	¾	63·1	1	66·3	1	54·7	½	32·4	1	37·0	¾	14·2	1
4340	49·7	1½	80·4	1	68·4	1½	46·9	1¼	48·1	1½	20·2	¼	26·7	¾
4267	49·4	1	55·2	1½	60·8	1	60·9	½	......	....	+35·1	½	23·1	1½
4143	50·3	¾	68·4	1	54·7	1¼	46·3	1	51·4	1	......	....	16·6	1½
4121	......	....	41·6	1	+57·4	1	43·8	1	41·8	1	......	....	10·2	½
4101	26·7	½	......	....	......	....	53·2	1	36·5	1	......	....	......	....
4026	+70·1	½	+67·0	1½	......	....	+41·0	1	+48·2	¾	......	....	+18·1	1½
Weighted Mean	+42·92		+59·10		+58·62		+47·48		+43·21		+38·29		+16·58	
V_a	+17·71		+14·23		+14·23		+12·82		+12·82		+10·97		+10·51	
V_d	− ·09		+ ·02		− ·06		+ ·17		+ ·10		− ·18		+ ·14	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+60·3		+73·1		+72·5		+60·2		+55·8		+48·8		+27·0	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	2999.		3094.		3099.		3100.		3101.		3143.		3159.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	.....	...	.....	...	.....	...	.....	...	.....	...	+39·3	½	.....	...
4471	+31·8	1	+12·2	1	+26·0	¼	.....	...	+11·8	¾	27·5	¾	+29·6	½
4388	19·6	1½	11·8	1½	17·2	¾	+14·6	½	24·4	½	22·5	½	31·9	½
4340	16·9	1	17·2	½	24·0	½	13·5	½	10·3	1	18·7	1	23·1	¾
4267	3·0	¾	5·5	1	+18·5	½	27·9	1	17·5	1½	24·1	½	37·3	1
4143	.....	...	+15·3	½	.....	...	+27·3	½	2·8	¾	12·7	1	22·1	¾
4121	39·0	¾	.....	...	.....	...	.....	...	18·8	1	22·9	¾	+49·8	½
4101	29·3	¾	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...
4026	+ 7·3	1½	.....	...	.....	...	.....	...	+20·0	½	+17·4	½	.....	...
Weighted Mean	+19·64		+11·49		+21·10		+22·24		+14·42		+21·97		+31·73	
V_a	+10·51		− 9·95		−10·91		−11·43		−11·43		−16·97		−19·37	
V_d	+ ·11		+ ·04		+ ·12		− ·04		− ·11		− ·28		− ·06	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+30·0		+ 1·3		+10·0		+10·5		+ 2·6		+ 4·4		+12·0	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	3160.		3203.		3319.		3320.		2808		3352.		3356.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	.....	...	.....	...	+57·4	½	.....	...	+76·5	½	+49·5	¼	+67·6	¼
4471	+37·1	¾	+52·7	1	66·0	¾	+35·9	1	53·0	1	60·1	1¼	51·1	¾
4388	33·9	½	.....	...	60·1	1	43·1	¾	49·9	1½	44·9	1	89·8	½
4340	23·7	1¼	39·8	¾	53·1	1½	35·4	¾	55·0	1¼	62·5	1½	60·6	½
4267	.....	...	40·6	¼	62·6	1	45·0	¾	52·7	¼	62·9	1	.....	...
4143	+ 4·4	½	42·8	1	50·6	1	58·2	½	66·9	1	45·2	½	.....	...
4121	.....	...	43·1	¾	54·3	½	.....	...	.....	...	.....	...	.....	...
4101	.....	...	32·5	1¼	44·3	½	43·0	1	58·9	½	43·4	½	.....	...
4026	.....	...	+49·1	1	+45·2	1	+53·9	1	+58·1	1	+47·5	1	+82·3	½
Weighted Mean	+25·54		+42·92		+54·92		+44·27		+57·50		+54·41		+67·75	
V_a	−19·37		−26·11		−29·09		−26·11		−29·41		−29·41		−29·50	
V_d	− ·13		− ·13		− ·12		− ·18		− ·22		− ·24		− ·24	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 5·8		+16·4		+25·4		+17·7		+27·6		+24·5		+37·7	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	3361.		3362.		3369.		3370.		3373.		3374.		3390.	
	Vel.	Wt.	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	+68·8	1	+111·3	1	+131·7	$\frac{3}{4}$	+86·6	$\frac{3}{4}$	+97·0	$\frac{3}{4}$	+98·4	$\frac{1}{2}$		
4471	90·6	1	107·1	$\frac{1}{2}$	101·3	$\frac{3}{4}$	82·9	$1\frac{1}{4}$	98·8	1	89·1	$\frac{1}{2}$	+50·0	$1\frac{1}{2}$
4388	97·3	1	111·1	$\frac{3}{4}$	99·8	$1\frac{1}{2}$	90·5	1	99·2	1	104·0	1		
4340	116·1	1	77·0	$\frac{3}{4}$	113·8	$\frac{1}{2}$	114·7	1	100·7	1	96·5	1	72·1	1
4267			109·4	1	124·0	1	100·1	$1\frac{1}{4}$	109·7	$\frac{3}{4}$	91·9	$\frac{1}{2}$	72·8	1
4143	125·4	$\frac{3}{4}$	106·7	$\frac{1}{2}$	+103·6	$\frac{3}{4}$	88·7	1	63·8	$\frac{3}{4}$	82·6	1	40·6	1
4121	+80·4	1	100·0	$\frac{1}{2}$			99·6	$\frac{1}{2}$			103·0	1	54·7	1
4101			121·0	$\frac{1}{2}$					99·9	$\frac{1}{2}$	92·0	1		
4026			+108·6	$\frac{1}{2}$			+107·1	1	+97·8	$\frac{3}{4}$	+90·5	$1\frac{1}{2}$	+52·3	$\frac{1}{2}$
Weighted Mean	+ 95·17		+105·65		+111·06		+ 96·04		+ 96·17		+ 94·13		+ 56·90	
V_a	− 29·30		− 29·30		− 28·99		− 28·88		− 28·78		− 28·78		− 27·23	
V_d	− ·24		− ·28		− ·19		− ·16		− ·15		− ·21		− ·28	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 65·3		+ 75·8		+ 81·6		+ 66·7		+ 67·0		+ 64·9		+ 29·1	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	3401.		3404.		3653.		3670.		3671.		3688.		3703.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	+57·6	$\frac{1}{2}$							− 5·7	$\frac{1}{2}$	−22·4	$\frac{1}{4}$		
4471	31·3	$\frac{3}{4}$			+ 3·8	$\frac{1}{2}$			32·9	$\frac{1}{2}$	6·6	$\frac{1}{2}$		
4388	43·0	$\frac{3}{4}$	+46·6	$\frac{3}{4}$	− 1·1	$\frac{1}{2}$	− 1·5	$\frac{1}{2}$	37·6	$\frac{1}{2}$	4·2	$\frac{3}{4}$	−20·8	$\frac{1}{2}$
4340	39·7	1	+47·0	$\frac{1}{2}$	−24·9	$\frac{1}{2}$	−18·5	$\frac{1}{2}$	23·5	1	18·1	$1\frac{1}{4}$	−17·9	$\frac{1}{2}$
4267	32·0	1					−16·3	$\frac{1}{4}$			17·3	$\frac{3}{4}$		
4143	57·8	$\frac{3}{4}$			−16·6	$\frac{1}{2}$	−14·6	$\frac{1}{4}$	17·3	1				
4121					− 6·6	$\frac{1}{2}$							−12·0	$\frac{1}{4}$
4101					−20·2	$\frac{1}{2}$			−13·2	$\frac{1}{2}$			+ 4·5	$\frac{1}{2}$
4026	+32·0	$\frac{1}{2}$									−26·3	$\frac{1}{2}$	−15·4	$\frac{1}{2}$
Weighted Mean	+41·08		+46·72		−10·92		−11·80		−21·38		−11·95		−12·34	
V_a	−25·17		−24·35		+28·99		+29·13		+29·13		+29·32		+29·23	
V_d	− ·28		− ·29		+ ·12		+ ·18		+ ·12		+ ·10		+ ·12	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+15·3		+21·8		+17·9		+17·2		+ 7·6		+17·2		+16·7	

DETAILED MEASURES OF ν ORIONIS—(Continued).

λ	3704.		3822.		3823.		3828.		3837.		3847.		3865.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	......	....	+ 4·5	½	+18·5	½	......	....	......	....	+37·1	½	+34·0	¾
4471	−38·2	½	31·7	½	36·0	¾	+12·0	¾	+44·5	¾	44·5	1	56·6	½
4388	6·4	¾	23·6	¾	10·5	¾	45·8	¾	47·9	½	28·7	1	51·1	¾
4340	11·1	½	......	....	26·2	¾	21·9		33·6	1	45·6	1	38·2	¾
4267	29·8	½	17·8	½	47·1	½	23·4	½	38·4	1	36·6	1	72·1	½
4143	1·8	½	34·8	¾	+19·9	½	36·1	½	42·1	½	59·3	¾	59·8	¼
4121	17·8	¼	31·9	½	......	....	......	....	32·6	¾	45·6	1	+47·1	1
4101	......	....	......	....	......	....	50·2	½	35·0	1	42·3	¾	......	....
4026	−42·3	½	+14·8	½	......	....	+10·2	½	+28·6	1	+46·8	1	......	....
Weighted Mean	−22·57		+24·23		+25·94		+27·82		+36·37		+42·82		+49·75	
V_a	+29·23		+ 8·60		+ 8·60		+ 8·05		+ 7·14		+ 6·57		+ 5·00	
V_d	+ ·06		− ·19		− ·25		− ·23		+ ·07		− ·15		− ·26	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 6·4		+32·4		+34·0		+35·4		+43·3		+48·0		+54·2	

DETAILED MEASURES OF ν ORIONIS—(Concluded).

λ	3878.		3879.		3890.		3908.		3909.					
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	+69·2	1	......	....	+96·5	¼	+28·1	½	+ 9·3	¼	......	....	......	....
4471	71·3	1	+78·0	½	66·6	¾	17·7	½	38·5	1	......	....	......	....
4388	82·7	1	81·0	1	73·8	¾	33·2	¾	36·1	1	......	....	......	....
4340	61·8	1	70·3	1	59·0	1	66·5	¾	46·3	1	......	....	......	....
4267	84·7	1	76·2	1	86·7	½	60·5	½	32·0	½	......	....	......	....
4143	93·2	¼	73·3	½	81·2	¾	29·9	½	......	....	......	....	......	....
4121	73·9	½	......	....	74·9	½	36·7	½	31·9	¾	......	....	......	....
4101	69·7	¾	89·8	¾	87·9	1	52·4	½	29·8	1	......	....	......	....
4026	+76·0	1	+87·2	¾	+57·5	1	+23·5	1	+50·3	½	......	....	......	....
Weighted Mean	+74·43		+79·28		+73·16		+38·35		+36·36		....		....	
V_a	+ 3·04		+ 3·04		− 0·09		− 4·30		− 4·30		....		....	
V_d	+ ·06		− ·01		− ·08		− ·13		− ·19		....		....	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		....		....	
Radial Velocity	+77·5		+82·0		+72·7		+33·6		+31·6		....		....	

The velocities of the 117 plates used in this discussion and other data regarding them is summed up in the following table of measures. The phases are reckoned from the periastron finally adopted, Julian Date 2,417,975.16 and the residuals are scaled to about ±0.2 km. from the curve representing the final elements.

MEASURES OF ν ORIONIS.

Plate.	Julian Date.	Phase.	Vel.	Wt.	O−C.
1140	2,417,891·93	48·03	+ 5·0	4	− 4·4
1160	903·78	59·88	+12·0	3	+ 3·4
1184	914·92	71·02	+ 4·5	5	− 4·3
1185	914·95	71·05	+ 3·9	5	− 4·9
1197	938·73	94·83	+12·6	6	− 0·3
1198	938·75	94·85	+15·2	4	+ 2·3
1217	944·73	100·83	+18·1	6	+ 2·7
1223	954·81	110·91	+23·8	5	+ 1·1
1224	954·84	110·94	+30·6	5	+ 7·9
1229	955·84	111·94	+28·1	3	+ 3·3
1235	957·54	113·64	+22·5	4	− 1·5
1250	961·71	117·81	+37·6	6	+ 4·8
1251	961·73	117·83	+36·5	3	+ 3·7
1261	963·78	119·88	+37·4	5	0·0
1273	965·59	121·69	+41·4	6	− 1·3
1282	968·58	124·68	+52·6	4	− 1·6
1302	970·65	126·75	+51·0	7	−11·5
1303	970·67	126·77	+60·4	6	− 2·1
1314	975·62	0·46	+73·5	4	− 2·7
1320	980·70	5·54	+56·1	7	+ 0·5
1325	989·65	14·49	+29·5	6	+ 0·7
1326	989·66	14·50	+14·7	3	−15·5
1335	992·57	17·41	+22·5	5	− 2·1
1337	993·69	18·53	+30·8	7	+ 7·6
1348	994·72	19·56	+28·5	6	+ 6·2
1352	996·62	21·46	+26·7	6	+ 6·4
1377	2,418,005·68	30·52	+21·4	4	+ 7·0
1385	010·68	35·52	+12·2	6	− 0·1
1396	017·53	42·37	+14·3	6	+ 3·8
1485	047·56	72·40	+16·9	2	+ 8·1
1497	049·53	74·37	+10·3	6	+ 1·4
1503	054·55	79·39	− 0·3	2	− 9·6
1916	217·94	111·52	+20·0	3·5	− 3·4
1943	234·96	128·54	+63·0	1·5	− 7·5
2009	283·85	46·17	+ 7·1	5	− 2·6
2010	283·87	46·19	+ 2·0	1·5	− 7·7
2019	285·87	48·19	+ 3·6	3	− 5·7
2020	285·90	48·22	+ 0·3	2·5	− 9·0
2025	286·67	48·99	− 3·0	3	−12·2
2034	292·82	55·14	+ 8·9	5	0·0
2035	292·85	55·17	− 2·8	4	−11·7
2061	297·85	60·17	+ 2·6	5	− 6·0
2133	320·79	83·11	+10·3	7·5	+ 0·4
2147	322·78	85·10	+ 6·2	2	− 4·1
2230	341·70	104·02	+11·8	6	− 6·2
2257	346·72	109·04	+20·7	6	0·0
2339	374·70	5·76	+51·7	6	− 3·0
2380	381·69	12·75	+35·9	5	+ 3·2
2410	388·67	19·73	+30·0	4	+ 8·0
2428	389·66	20·72	+30·9	6	+ 9·9
2446	397·62	28·68	+24·2	7	+ 9·0
2524	425·55	56·61	+12·6	7	+ 3·8

MEASURES OF ν ORIONIS—(Continued).

Plate.	Julian Date.	Phase.	Vel.	Wt.	O−C.
2781	2,418,557·89	57·69	+14·0	7	+ 5·3
2808	570·88	70·68	+ 9·0	4	+ 0·2
2809	570·91	70·71	+ 7·1	6	− 1·7
2831	578·89	78·69	+ 8·8	8	− 0·4
2832	578·92	78·72	+10·1	7	+ 0·8
2844	584·81	84·61	+ 5·6	6	− 4·6
2876	588·84	88·64	+ 3·9	5	− 6·0
2877	588·87	88·67	+ 0·1	4	−10·8
2898	599·95	99·75	+19·6	5	+ 4·7
2907	600·84	100·64	+ 9·5	6	− 5·7
2908	600·90	100·70	+20·4	8	+ 5·0
2927	609·86	109·66	+16·0	8	− 5·3
2928	609·90	109·70	+20·9	8	− 0·3
2939	619·95	119·75	+38·4	8	+ 1·4
2942	620·88	120·68	+47·0	2	+ 7·1
2948	623·77	123·57	+54·5	7	+ 5·0
2949	623·81	123·61	+49·0	8	− 0·5
2957	626·82	126·62	+64·8	7	+ 2·0
2958	626·85	126·65	+60·3	7	− 2·5
2969	634·78	3·32	+73·1	8	+ 6·1
2970	634·82	3·36	+72·5	7	+ 5·5
2977	637·66	6·20	+60·2	6	+ 7·7
2978	637·69	6·23	+55·8	7	+ 3·3
2986	641·87	10·41	+48·8	2	+10·8
2998	642·68	11·22	+27·0	7	− 8·6
2999	642·70	11·24	+30·0	8	− 5·5
3094	682·64	51·18	+ 1·3	5	− 7·7
3099	684·60	53·14	+10·0	2	+ 1·0
3100	685·67	54·21	+10·5	3	+ 1·6
3101	685·71	54·25	+ 2·6	6	− 6·2
3143	697·79	66·33	+ 4·4	5	− 4·3
3159	703·63	72·17	+12·0	4	+ 3·2
3160	703·67	72·21	+ 5·8	3	− 3·0
3203	724·62	93·16	+16·4	8	+ 4·0
3319	742·57	111·11	+25·4	9	+ 2·3
3320	742·60	111·14	+17·7	7	− 5·4
3351	747·60	116·14	+27·6	7	− 2·2
3352	747·64	116·18	+24·5	8	− 5·3
3356	754·63	123·17	+37·7	3	− 6·7
3361	759·59	128·13	+65·3	7	− 3·7
3362	759·62	128·16	+75·8	6	+ 6·8
3369	763·55	0·83	+81·6	5	+ 6·0
3370	764·52	1·80	+66·7	8	− 6·0
3373	765·52	2·80	+67·0	7	− 2·0
3374	765·55	2·83	+64·9	9	− 4·1
3390	775·57	12·85	+29·1	7	− 3·0
3401	784·55	21·83	+15·3	5	− 4·7
3404	787·56	24·84	+21·8	1	+ 3·0
3653	929·92	35·94	+17·9	3	+ 5·6
3670	931·87	37·89	+17·2	2	+ 5·4
3671	931·91	37·93	+ 7·6	4	− 4·2
3688	936·91	42·93	+17·2	4	+ 6·9
3703	943·88	49·90	+16·7	2	+ 7·5
3704	943·91	49·93	+ 6·4	3	− 2·8
3822	2,419,011·87	117·89	+32·4	4	− 0·6
3823	011·90	117·92	+34·0	4	+ 1·0
3828	012·89	118·91	+35·4	5	+ 0·4
3837	014·71	120·73	+43·3	6	+ 3·3

MEASURES OF ν ORIONIS—(Concluded).

Plate.	Julian Date.	Phase.	Vel.	Wt.	O−C.
3847	2,419,015·82	121·84	+48·0	8	+ 5·0
3865	018·89	124·91	+54·2	4	+ 0·2
3878	022·69	128·71	+77·5	7	+ 5·8
3879	022·73	128·75	+82·0	5	+10·3
3890	027·75	2·51	+72·7	6	+ 1·4
3908	036·76	11·52	+33·6	5	− 1·4
3909	036·79	11·55	+31·6	6	− 3·4

For convenience of reference the early measures of Frost and Adams are appended:—

YERKES MEASURES OF ν ORIONIS.

Date.	Julian Date.	Phase.	Vel.	Residual from Ottawa Curve.
1903. Jan. 22	2,416,137·85	0·33	+81	+4·8
Oct. 31	419·94	19·90	+21	−0·8
Nov. 14	433·90	33·86	+12	−0·8

The first plate was stated to have such broad and fuzzy lines, owing to the dispersion of three prisms used, that the result was considered only a rough approximation. In a personal communication to the writer Professor Frost gives the velocities from the different lines used. These agree among themselves very closely and he suggests that the plate should be given considerable weight, and, no doubt, its result is close to the actual velocity. The period that suits all observations best is that given, viz.: 131.26 days, though possibly the first decimal place is as close as this can be relied on.

With this period the plates were grouped according to phase into fourteen normal places. The weight given to each group was approximately the sum of the weights of the individual plates comprising the group.

NORMAL PLACES

	Mean Phase.	Mean Vel.	Weight.	O−C.	Equation-Ephemeris.
1	2·77	+69·23	5·	− ·28	−·05
2	5·93	55·25	3·	+ ·50	+·10
3	11·75	31·69	4·5	−3·22	+·12
4	18·99	26·21	5·	+3·47	+·05
5	41·55	11·18	7·	+ ·56	−·04
6	56·46	7·99	4·5	− ·65	−·04
7	71·13	7·59	4·5	−1·07	−·06
8	84·52	8·38	5·	−1·83	−·05
9	99·65	15·46	4·5	+ ·68	−·03
10	109·27	21·98	5·5	+ ·82	−·03
11	116·95	30·66	4·5	− ·63	+·01
12	121·63	44·27	6·	+1·73	+·18
13	126·82	61·19	5·	−2·06	+·40
14	130·10	+78·79	2·5	+3·19	+·17

Preliminary elements were obtained by the graphical method of Dr. King,* as follows:—

$$
\begin{aligned}
P &= 131.26 \text{ days.}\\
e &= .575\\
\omega &= 0^\circ\\
K &= 33 \text{ km.}\\
\gamma &= +21.53 \text{ km.}\\
T &= \text{J. D. } 2417974.69.
\end{aligned}
$$

With these elements it was decided to make a least-squares solution. Using the differential form† of Lehmann-Filhés, fourteen observation equations were formed connecting the residuals with the elements γ, K, e, ω and T. The period was considered determined as closely as could be. For sake of homogeneity the following substitutions were made:—

$$
\begin{aligned}
x &= \delta\gamma\\
y &= \delta K\\
z &= K.\delta e = 33\,\delta e\\
u &= K.\delta\omega = 33\,\delta\omega\\
v &= \frac{K}{(1-e^2)^{\frac{3}{2}}}.\mu.\delta T \quad = \quad [0.46003]\ \delta T
\end{aligned}
$$

OBSERVATION EQUATIONS FOR ν ORIONIS.

	Weight.	x	y	z	u	v	$-n$
1	5	1·000	+1·362	− ·395	− ·617	+1·302	−2·76=0
2	3	"	+ ·972	−1·804	− ·918	+1·384	−1·66
3	4·5	"	+ ·415	−1·778	− ·987	+ ·814	+3·52
4	5	"	+ ·046	− ·823	− ·848	+ ·411	−3·18
5	7	"	− ·347	+ ·670	− ·388	+ ·086	−1·09
6	4·5	"	− ·415	+ ·959	− ·138	+ ·026	− ·17
7	4·5	"	− ·420	+ ·981	+ ·095	− ·017	+ ·06
8	5	"	− ·374	+ ·786	+ ·314	− ·065	+ ·79
9	4·5	"	− ·229	+ ·188	+ ·595	− ·172	−1·49
10	5·5	"	− ·022	− ·592	+ ·802	− ·346	−1·19
11	4·5	"	+ ·308	−1·563	+ ·964	− ·691	+1·04
12	6·	"	+ ·670	−2·041	+ ·995	−1·107	− ·64
13	5	"	+1·275	− ·829	+ ·714	−1·405	+2·42
14	2·5	"	+1·564	+ ·916	+ ·148	− ·365	−5·66

These were transformed into the normal equations :—

$$
\begin{aligned}
66.500x + 18.304y &- 25.698z + 5.476u - 3.667v - 37.475 = 0\\
33.604y &- 30.393z + 1.271u - 1.157v - 22.581\\
& 86.463z - 6.882u + 6.306v - 22.973\\
& 31.941u - 30.289v + 13.267\\
& 38.621v - 26.839
\end{aligned}
$$

* Astrophysical Journal, Vol. XXVII, p. 125.
† Astronomische Nachrichten 3242.

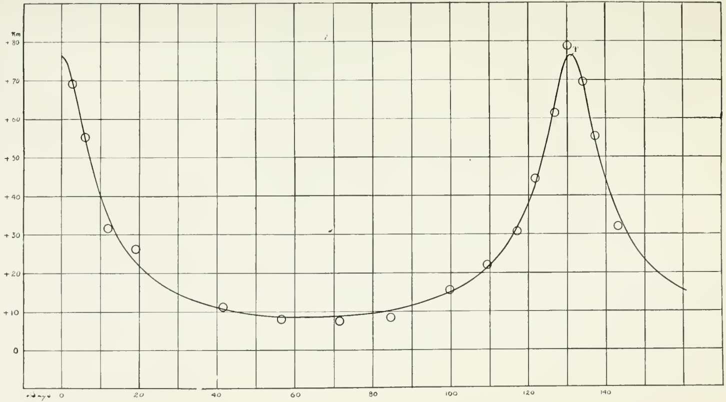


FIG. 5.—Velocity Curve of ν Orionis.

The following corrections resulted:—

$$\begin{aligned}
\delta\gamma &= + \ .57 \text{ km.}\\
\delta K &= +1.09 \text{ km.}\\
\delta e &= + \ .024\\
\delta\omega &= +1^\circ.58\\
\delta T &= + \ .47 \text{ d.}
\end{aligned}$$

giving as the corrected elements, with their probable errors:—

$$\begin{aligned}
P &= 131.26 \text{ days.}\\
e &= \ .599 \pm .014\\
\omega &= 1^\circ.58 \pm 2^\circ.12\\
\gamma &= + \ 22.10 \text{ km.} \pm .47 \text{ km.}\\
K &= 34.09 \text{ km.} \pm .75 \text{ km.}\\
T &= \text{J.D. } 2417975.16 \pm .38 \text{ days.}\\
A &= 54.50 \text{ km.}\\
B &= 13.68 \text{ km.}\\
a \sin i &= 49{,}270{,}000 \text{ km.}
\end{aligned}$$

The sum of the squares for the normal places was reduced from 298.5 to 205.9 about 31 per cent. The residuals given in the table of normal places are those from the final elements. The agreement between equation and ephemeris residuals was satisfactory, so that no further solution was necessary.

The probable error of a single observation obtained from columns 5 and 6 of the measures is ± 3.47 km. per sec. For this type of spectrum one would expect that this value should be somewhat lower, but remeasurement of many of the plates giving large residuals failed to make any sensible difference in the results. In a few cases as may be noted in the measures, plates made consecutively on the same night differ from each other by 10 to 12 km. per sec., so that the above value was not unexpected.

Quite recently Mr. Jordan*, of the Allegheny Observatory, in discussing the orbit of π Andromedæ calls attention to the large gap between the short and long periods for the helium stars. The star under discussion here furnishes another illustration of the marked increase of eccentricity with period, the value of e being .60 for an orbital period of 131 days.

The curve shown (Fig. 5) represents the corrected values of the elements.

The Spectroscopic Binary 7 Camelopardalis.

This star ($\alpha = 4^h\ 49^m.3$, $\delta = +53^\circ\ 35'$, photographic magnitude about 4.6) was announced as a spectroscopic binary by Campbell and Moore in 1907.† Work was commenced on the star here in December, 1908, and continued till March of the present year, when forty-four spectrograms in all had been secured.

The first eight plates were made with the single-prism instrument as first constructed, linear dispersion at $H\gamma$ being 30.2 tenth-metres per millimetre and

* Publications of the Allegheny Observatory. Vol. II. No. 8.

† Astrophysical Journal, Vol. XXVI, p. 292.

the remaining number with the new instrument whose dispersion at the same region is 33.4 tenth-metres per millimetre. Somewhat over a year ago a solution was made from the thirty-nine plates then secured and elements agreeing very closely with the present ones were obtained. Some slight irregularities in the curve seemed to indicate the presence of a second spectrum and five fine-grained plates have since been made at the crests of the curve for the sole purpose of deciding this question.

On plate 3555, which is weak, the *Mg.* line λ 4481 might be suspected as a double, but none of the other plates show any evidence whatever of the presence of the second spectrum.

This star is of type A2, Harvard classification, and has lines well adapted for measurement. Among the most frequently used were λλ 3933, 4101, 4233, 4340, 4481 and 4549. Many other lines mostly metallic were present, and when measured gave velocities in good agreement with the principal lines.

The wave-lengths of the lines employed in determining the velocities are given in the accompanying table.

LINES USED IN 7 CAMELOPARDALIS.

Element.	Wave-Length.	Element.	Wave-Length.
Fe	4584·018	*Ti*	4300·211
Fe	4549·766	*Fe-Fe*	4271·760
Ti	4534·139	*Fe*	4233·328
Mg	4481·400	*He*	4143·928
Fe	4404·927	*Si*	4128·211
Ti-V-Zr	4395·286	*H*	4101·890
H	4340·634	*Fe*	4045·975
Fe	4308·081	*Ca*	3933·825

The observational data of the plates is contained in the accompanying table which is taken from the regular observing book for spectrographic work, but somewhat abridged. This table is followed by the detailed measures of each plate showing the velocities deduced from each line.

RECORD OF SPECTROGRAMS

P—Plaskett.
H—Harper.
P[1]—Parker.
C—Cannon.

Star.	No. of Neg.	Camera	Plate.	Date.	Middle of Exposure. G.M.T.	Duration	Hour Angle at End.	Temp. Room Beg.	Temp. Room End.	Temp. Prism Box Beg.	Temp. Prism Box End.	Slit Width in Inches.	Seeing.	Observer	Remarks.
				1908	h m	m	h m								
7 Camelop.	1997	I L	Seed 27	Dec. 2	15 35	70	0 50 E	− 8·4	− 8·8	− 2·0	− 2·0	·0016	Fair	H	
"	2013	"	"	" 9	14 12	64	1 57 E	−14·0	−13·5	− 1·0	− 1·1	·0015	"	H	
"	2043	"	"	" 18	15 04	60	0 28 E	− 7·8	− 8·0	− 4·3	− 4·6	"	Good	C	
"	2052	"	"	" 21	13 52	65	1 25 E	− 7·2	−10·5	− 1·5	− 1·5	"	"	P[1]	
				1909											
"	2089	"	"	Jan. 6	12 20	60	1 58 E	−10·5	−12·0	− 2·5	− 2·5	"	"	H	
"	2137	"	"	" 15	13 01	60	0 45 E	−13·8	−12·5	− 4·4	− 4·4	·0016	"	C	
"	2222	"	"	Feb. 3	11 32	55	0 57 E	− 5·5	− 6·5	− 3·2	− 3·2	"	"	H	
"	2248	"	"	" 8	12 56	59	0 45 W	−10·5	−13·5	− 5·1	− 5·1	"	Fine	P[1]	
"	2338	I	"	Mar. 8	15 57	55	5 35 W	− 4·0	− 4·0	2·8	3·2	·002	Good	P[1]	Off 10^m
"	2409	"	"	" 22	15 29	52	6 00 W	1·0	− 0·2	5·6	5·5	"	Fair	P[1]	
"	2507	"	"	Apr. 23	14 47	46	7 25 W	5·5	4·5	10·8	10·8	"	Good	C	
"	2519	"	"	" 26	15 11	68	8 20 W	6·0	5·1	9·4	9·3	"	Fair	P[1]	
"	2835	"	"	Sept. 30	16 24	41	4 45 E	10·1	10·1	14·0	13·9	"	5	P[1]	
"	2843	"	"	Oct. 4	18 37	45	2 00 E	11·0	11·0	23·0	22·9	"	5	H	
"	2856	"	"	" 6	15 38	54	4 40 E	14·6	14·2	20·5	20·4	"	3	P[1]	
"	2872	"	"	" 8	16 58	54	3 18 E	14·5	15·5	22·9	22·8	"	5	H	
"	2909	"	"	" 20	22 05	5	2 12 W	− 0·2	+ 0·5	6·9	6·9	"	4	C	
"	2950	"	"	Nov. 12	20 26	18	2 00 W	6·2	6·0	15·6	15·4	"	4–0	P[1]	
"	2975	"	"	" 26	14 12	56	2 50 E	1·5	1·5	6·6	6·4	"	3	H	Haze.
"	2992	"	"	Dec. 1	13 15	40	3 35 E	1·5	1·0	6·5	6·4	"	4	P	
"	3066	"	"	" 29	15 50	41	0 30 W	−16·5	−16·5	− 8·0	− 8·0	"	3–0	H	
"	3075	"	"	" 30	14 45	60	0 05 E	−11·8	−11·0	− 7·0	− 7·0	"	3–2	P	
"	3080	"	"	" 31	14 40	80	0 00	......	......	......	......	....	2–0	H	
				1910											
"	3093	"	"	Jan. 10	14 17	55	0 10 W	−13·5	−15·0	− 3·7	− 3·8	"	3	H	
"	3098	"	"	" 12	13 27	65	0 30 E	− 6·7	− 8·0	− 3·0	− 3·2	"	4–3–4	P[1]	
"	3111	"	"	" 14	18 27	55	4 35 W	−14·0	−14·5	− 7·8	− 8·8	"	5	H-P[1]	
"	3125	"	"	" 15	19 05	50	5 15 W	−14·0	−14·0	− 9·3	− 9·3	"	....	P	
"	3138	"	"	" 19	14 51	38	2 10 W	− 4·0	− 4·3	− 0·9	− 0·7	"	4–0	P[1]	
"	3154	"	"	" 28	14 05	67	1 15 W	− 5·6	− 6·5	1·4	1·2	"	4–3–2	C	
"	3157	"	"	" 31	13 00	71	0 15 W	− 6·4	− 7·5	1·6	1·6	"	4–5	C	

P—Plaskett.
H—Harper.
P¹—Parker.
C—Cannon.

RECORD OF SPECTROGRAMS—(Concluded).

Star.	No. of Neg.	Camera	Plate.	Date.	Middle of Exposure. G.M.T.	Duration	Hour Angle at End.	Temperature Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width in Inches.	Seeing.	Observer	Remarks.
				1910	h m	m	h m								
7 Camelop.	3185	I	Seed 27	Feb. 14	12 08	50	0 10 W	0·4	− 2·0	3·2	2·9	·002	3–4	P	
"	3191	"	"	" 16	14 00	89	2 30 W	−12·4	−11·5	− 4·3	− 4·4	"	3–0	P¹	
"	3195	"	"	" 18	13 06	47	1 28 W	−10·0	−10·0	− 2·5	− 2·5	"	3–4	H	
"	3204	"	"	" 21	15 46	57	4 25 W	− 4·6	− 6·8	3·0	2·7	"	4–5	C	
"	3207	"	"	" 23	12 30	50	1 20 W	− 9·0	−10·9	− 3·9	− 4·1	"	4	P¹	
"	3246	"	"	" 28	14 35	50	3 40 W	5·2	3·6	10·4	9·9	"	3–4–5	C	
"	3254	"	"	Mar. 2	13 40	51	2 55 W	4·0	2·9	10·6	10·6	"	4–2–0	P¹	
"	3295	"	"	" 9	15 29	52	5 10 W	− 4·2	− 4·5	1·4	1·3	"	4	P¹	
"	3339	"	"	" 18	12 33	53	2 47 W	− 1·0	− 0·5	3·2	3·0	"	4	H	
"	3555	"	"	Aug. 2	20 26	78	4 00 E	17·0	15·5	22·4	22·0	"	4	P¹	
"	3561	"	Seed 23	" 8	18 57	85	6 08 E	18·0	16·5	26·8	26·2	"	4–5	H	Off 10m
"	3608	"	"	" 31	21 10	80	1 25 E	13·5	13·0	22·3	22·3	"	4	C	
				1911											
"	4058	"	"	Mar. 6	14 35	90	4 20 W	− 4·0	− 5·5	0·6	0·2	"	4–5	C	
"	4079	"	"	" 8	15 32	105	5 30 W	− 4·2	− 6·4	3·6	3·3	"	4	P¹	

DETAILED MEASURES OF 7 CAMELOPARDALIS.

λ	1997.		2013.		2043.		2052.		2089.		2137.		2222.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549..........	......	....	− 5·4	1	+27·6	1	+9·5	½	+31·8	¾	......	....	......	....
4481..........	+14·3	1½	−29·8	½	28·7	1½	0·7	1	57·3	½	......	....	+35·6	2
4340..........	16·8	1¼	......	....	28·1	1	15·8	½	35·8	1	......	....	57·6	1
4143..........	......	....	......	....	25·2	1	9·0	1	28·9	½	......	....	......	....
4128..........	......	....	......	....	......	....	22·8	½	46·0	1	......	....	......	....
4101..........	25·5	¾	......	....	......	....	......	....	33·9	½	+ 6·1	1	47·0	1
4071..........	......	....	......	....	......	....	7·6	½	......	....	......	....	......	....
3933..........	+21·5	1½	......	....	+19·7	1	+ 7·7	1½	+32·9	1½	+15·5	1½	+40·7	1
Weighted Mean......	+18·77		−13·58		+26·11		+ 8·93		+37·42		+11·74		+43·32	
V_a	+ 3·12		− ·02		− 4·09		− 5·41		−12·20		−15·65		−21·50	
V_d	+ ·08		+ ·12		+ ·05		+ ·10		+ ·12		+ ·04		+ ·08	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	+21·7		−13·8		+21·8		+ 3·3		+25·0		− 4·1		+21·6	

DETAILED MEASURES OF 7 CAMELOPARDALIS—(Continued).

λ	2222. (check)		2248.		2338.		2409.		2507.		2519.		2835.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549..........	......	....	− 9·7	1	+ 6·8	1	− 9·6	½	−30·4	1	−12·7	½	......	....
4481..........	+32·4	2	17·3	1½	− 6·1	1½	+11·4	2	−30·6	1¼	+ 8·7	1¼	−43·9	2
4340..........	55·1	¾	22·9	½	+ 7·9	1	+25·2	1	......	..	− 0·9	¼	36·7	1½
4233..........	......		......	....	+ 8·1	½	......	....	......	....	......	....	......	....
4143..........	......	....	13·2	½	......	....	......	....	......	....	......	....	......	....
4101..........	23·1	½	....	....	......	....	+ 7·6	¾	......	.	......	....	......	....
3933..........	+42·7	1½	−30·1	½	− 2·4	1	+31·5	½	....	.	......	...	−47·0	1½
Weighted Mean.......	+39·09		−17·19		+ 1·21		+13·60		−30·52		+ 2·14		−41·42	
V_a	−21·50		−22·66		−25·72		−24·97		−18·15		−17·19		+23·92	
V_d	+ ·08		− ·01		− ·19		− ·21		− ·19		− ·18		+ ·19	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity.	+17·4		−40·1		−25·0		−11·9		−49·1		−15·5		−16·6	

DETAILED MEASURES OF 7 CAMELOPARDALIS—(Continued).

λ	2843.		2856.		2872.		2909.		2950.		2950. (check)		2975.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	−50.3	½	−40.0	1					−12·9	1	−12·0	1		
4534									22·3	½	23·9	½		
4481	37·1	½	32·3	1½	−36·3	1	+ 9·9	1	2·3	2½	3·3	2½	−23·2	1
4400													42·0	1½
4340	21·3	1			25·7	1			22·7	¼	23·2	¼	33·5	1
4233	45·6	½	31·2	1					−28·8	¼	−25·5	¼	22·3	1
4128					19·2	½								
4101	25·5	½			16·3	1								
4063					30·6	½								
4045					32·9	½							36·8	½
3933	−20·4	1½	−44·4	½	−32·9	2							−36·3	1½
Weighted Mean	−29·15		−35·44		−28·64		+ 9·94		− 9·50		−10·00		−32·17	
V_a	+23·26		+22·92		+22·56		+19·58		+11·69		+11·69		+ 5·92	
V_d	+ ·12		+ ·19		+ ·17		− ·10		− ·13		− ·13		+ ·15	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 5·0		−12·6		− 6·1		+29·1		+ 1·8		+ 1·3		−26·4	

DETAILED MEASURES OF 7 CAMELOPARDALIS—(Continued).

λ	2992.		3066.		3075.		3080.		3093.		3098.		3111.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4563									+47·0	½				
4549	−36·7	1			+32·4	1	−16·7	½	34·0	½	−36·0	1	+45·0	½
4534									54·9	½				
4481	36·2	2	+31·5	½	17·5	1½	8·7	¾	22·7	½	26·1	1½	54·1	1½
4352									25·0	¾				
4340	36·2	1	14·6	1	28·9	1			45·9	¾			40·5	1
4300					27·8	½								
4233	24·6	1	41·8	½	49·3	½	−32·1	½	43·9	½	17·8	½		
4101	26·5	½			18·9	1			36·8	½			31·7	½
4045	44·4	½											40·2	½
3933	−43·3	1	+10·6	2	+12·6	2			+39·3	1	−26·0	1	+45·0	2
Weighted Mean	−35·51		+18·13		+22·70		−17·62		+39·03		−25·05		+44·98	
V_a	+ 3·72		− 8·84		− 9·25		− 9·67		−13·71		−14·45		−15·22	
V_d	+ ·18		·00		+ ·03		+ ·03		+ ·01		·00		− ·14	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−31·9		+ 9·0		+13·2		−27·5		+25·0		−39·8		+29·3	

DETAILED MEASURES OF 7 CAMELOPARDALIS—(Continued).

λ	3125.		3138.		3154.		3157.		3185.		3191.		3195.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584					−31·6	½								
4549	−22·7	½	+12·9	1½	31·0	½			+30·7	½	−56·0	½		
4534					40·9	¼								
4481	− 0·2	1½	0·0	1½	15·9	1¼	− 5·1	1	59·4	1	2·5	1¼	+55·3	1¼
4404							+ 8·8	1						
4340	+ 5·3	1	9·7	½	32·4	1½	+ 9·3	¾	45·1	1½	15·6	1	40·0	1
4271					24·7	½								
4233	+ 2·2	1					+ 4·3	½			− 2·7	¼		
4143	−19·1	½												
4128	+14·6	½												
4101	+ 7·1	½							56·3	1			48·1	½
3933	− 1·7	2	+ 8·0	½	+13·0	1½	−15·8	1¼	+45·9	2			+49·9	1¼
Weighted Mean	− 0·82		+ 7·08		−22·99		− 1·54		+48·44		−15·83		+48·91	
V_a	−15·65		−16·99		−19·83		−20·66		−23·76		−24·06		−24·36	
V_d	− ·15		− ·07		− ·03		− ·01		+ ·01		− ·07		− ·05	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−16·9		−10·3		−43·1		−22·5		+24·4		−40·2		+24·2	

DETAILED MEASURES OF 7 CAMELOPARDALIS—(Continued).

λ	3204.		3207.		3246.		3254.		3295.		3339.		3555.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4563											+11·4	½		
4549	0·0	½	+ 1·6	½	−17·6	1			+32·0	½	7·6	½		
4481	+29·3	¾	23·6	1½	23·6	1	+52·1	1	52·3	1½	51·3	½	−61·8	¾
4395													−86·0	¼
4340	28·3	1¼	19·8	¾	21·5	1	30·1	½	53·2	1½	33·3	1½		
4308									41·5	1				
4233			20·4	¾	4·3	½								
4227											36·4	½		
4143									65·7	¼	29·3	¾		
4128											26·8	¾		
4101	24·1	1			14·4	¾	50·0	¼			26·4	1		
3933	+16·6	1½	+11·6	½	−27·2	1	+49·7	1¼	+58·7	¼	+28·7	2		
Weighted Mean	+21·29		+18·03		−19·60		+47·29		+47·90		+28·68		−67·89	
V_a	−24·81		−25·11		−25·45		−25·56		−25·72		−25·37		+19·99	
V_d	− ·18		− ·05		− ·15		− ·10		− ·19		− ·11		+ ·19	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 4·0		− 7·3		−45·5		+21·3		+21·7		+ 2·9		−48·0	

DETAILED MEASURES OF 7 CAMELOPARDALIS—(Concluded).

λ	3561.		3608.		4058.		4079.							
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584					+54·2	½								
4572	+ 0·1	¼												
4549	− 9·8	¾	− 3·3	½	52·7	1	−19·2	1						
4534							12·4	½						
4481	− 0·1	1½	+ 6·7	1	54·6	1½	−17·5	1½						
4233	+10·0													
4227					52·1	½								
3933					+55·7	1½								
Weighted Mean	− 0·83		+ 3·40		+54·28		−17·21							
V_a	+21·45		+25·00		−25·70		−25·72							
V_d	+ ·21		+ ·10		− ·16		− ·19							
Curv.	− ·28		− ·28		− ·28		− ·28							
Radial Velocity	+20·5		+28·2		+28·1		−43·4							

The following table contains a summary of the measures. The phases are reckoned from periastron passage J. D. 2,418,281.176 using the period 3.8846 days. The residuals in the last column are scaled from the curve representing the final elements.

MEASURES OF 7 CAMELOPARDALIS

Plate.	Julian Date.	Phase.	Vel.	Number of lines.	Weight.	O−C.
1997	2,418,278·649	1·358	+21·7	5	4	−2·9
2013	285·591	·530	−13·8	2	1	−2·8
2043	294·628	1·798	+21·8	5	5	−0·7
2052	297·578	·864	+ 3·3	7	5	−4·2
2089	313·514	1·261	+25·0	7	6	+2·2
2137	322·542	2·520	− 4·1	2	2	+4·9
2222	341·480	2·035	+19·1	4	5	+3·9
2248	346·539	3·209	−40·1	5	4	+0·4
2338	374·664	·258	−25·0	5	5	+0·5
2409	388·645	2·585	−11·9	5	5	+0·6
2507	420·616	3·479	−49·1	2	2	−4·6
2519	423·633	2·611	−15·5	3	2	−1·3
2835	580·683	·393	−16·6	3	5	+2·2
2843	584·776	·601	− 5·0	6	5	+2·2
2856	586·652	2·477	−12·6	4	4	−6·1
2872	588·707	·648	− 6·1	7	6	−1·6
2909	600·920	1·207	+29·1	1	1	+7·8
2950	623·851	·830	+ 1·5	5	5	−4·5
2975	637·591	2·916	−26·4	6	6	+3·6
2992	642·552	·108	−31·9	7	7	+0·6
3066	670·660	1·024	+ 9·0	4	4	−6·0
3075	671·614	1·978	+13·2	7	7	−3·8
3080	672·611	2·975	−27·5	3	2	+5·0
3093	682·595	1·305	+25·0	9	5	+1·2
3098	684·561	3·271	−39·8	4	4	+2·3

MEASURES OF 7 CAMELOPARDALIS—(Concluded).

Plate.	Julian Date.	Phase.	Vel.	Number of lines.	Weight.	O−C.
3111	2,418,686·769	1·595	+29·3	7	7	+3·7
3125	687·795	2·621	−16·9	8	7	−2·4
3138	691·619	2·560	−10·3	4	4	+0·7
3154	700·586	3·758	−43·1	7	6	−2·1
3157	703·542	2·829	−22·5	5	4	+3·7
3185	717·506	1·255	+24·4	5	6	+1·6
3191	719·583	3·332	−40·2	4	3	+2·9
3195	721·546	1·410	+24·2	4	4	−1·0
3204	724·657	·636	− 4·0	5	5	+0·7
3207	726·521	2·500	− 7·3	5	4	+0·7
3246	731·607	3·702	−45·5	6	5	−3·5
3254	733·570	1·780	+21·3	4	3	−1·9
3295	740·646	1·087	+21·7	6	4	+4·2
3339	749·523	2·194	+ 2·9	9	8	−5·1
3555	886·853	3·564	−48·0	2	1	−3·8
3561	892·790	1·732	+20·5	4	3	−3·2
3608	8,915·882	1·516	+28·2	2	2	+2·2
4058	9,102·607	1·780	+28·1	4	5	+5·1
4079	9,104·647	3·820	−43·4	3	3	−3·9

Through the kindness of Professor Campbell the G. M. T. of the Lick plates were obtained and for completeness those observations are given here.

LICK OBSERVATIONS

Date.	Julian Date.	Phase.	Vel.	O−C.
1902. Nov. 4....	2,416,058·987	3·687	−36·5*	+6·0
1903. Dec. 6....	6,455·971	·557	−18·5*	−9·2
1907. Feb. 7....	7,614·721	1·696	+20·5	−4·4
" 27....	7,634·694	2·246	− 3·2	−8·7
Mar. 13....	7,648·724	·738	− 1·8	−2·6
Apr. 22....	7,688·692	1·860	+22·5	+1·5
Aug. 8....	7,796·976	1·375	+23·0	−2·0

There is some uncertainty as to the exact period. Our own observations gave the value 3.885 days, and when the Lick observations were used in conjunction with our own, a period of 3.8848 days was obtained. This satisfied all their observations well, except the second which had a residual of −15 km. As the agreement of the two approximate measures made on this plate seemed to make it trustworthy, it was thought best to equalize the residuals by changing the period to 3.8846 and this is the value here accepted.

The observations were now grouped into sixteen normal places, the weights assigned each group being in general one-tenth of the sum of the weights of the individual plates comprising the group.

* Means of two approximate measures.

NORMAL PLACES

	Mean Phase	Mean Vel.	Wt.	O—C.		Mean Phase	Mean Vel.	Wt.	O—C.
1	·170	−29·02	1·0	+1·29	9	2·002	+15·66	1·0	− ·95
2	·416	−16·13	·5	+1·29	10	2·194	+ 2·90	·5	−5·45
3	·630	− 5·10	1·5	+ ·03	11	2·495	− 8·78	1·0	−1·20
4	·847	+ 2·40	·8	−4·31	12	2·581	−11·97	1·0	+ ·42
5	1·055	+15·35	·7	− ·80	13	2·697	−18·94	·9	− ·15
6	1·268	+25·03	2·0	+2·22	14	2·931	−26·67	·6	+3·90
7	1·486	+26·19	2·0	+ ·42	15	3·311	−41·25	1·5	+1·61
8	1·777	+23·43	2·0	+ ·17	16	3·717	−44·65	1·5	−2·59

Preliminary values of the elements were obtained by Dr. King's graphical method, and then a least-squares solution was made. As the eccentricity was small the time of periastron passage was taken as fixed and a value of ω assumed, so that only the four elements γ, K, e and ω entered into the solution.

For the sake of homogeneity, the following substitutions were made:—

$$
\begin{aligned}
x &= \delta\gamma \\
y &= \delta K \\
z &= K.\delta e = 35.\delta e \\
u &= K.\delta\omega = 35.\delta\omega
\end{aligned}
$$

OBSERVATION EQUATIONS FOR 7 CAMELOPARDALIS.

	Weight.	x	y	z	u	$-n$
1	1·0	1·000	−·585	−·343	+ ·811	− ·65=0
2	·5	"	−·225	+·431	+ ·975	− ·94
3	1·5	"	+·119	+·908	+ ·993	+ ·06
4	·8	"	+·453	+·964	+ ·891	+4·25
5	·7	"	+·722	+·588	+ ·692	+ ·72
6	2·0	"	+·913	−·061	+ ·407	−2·27
7	2·0	"	+·998	−·693	+ ·067	− ·47
8	2·0	"	+·920	−·991	− ·393	− ·44
9	1·0	"	+·719	−·649	− ·695	+ ·31
10	·5	"	+·473	−·085	− ·881	+4·45
11	1·0	"	+·006	+·776	−1·000	− ·22
12	1·0	"	−·133	+·919	− ·991	−1·88
13	·9	"	−·315	+·999	− ·949	−1·30
14	·6	"	−·644	+·747	− ·765	−5·07
15	1·5	"	−·967	−·376	− ·254	−1·80
16	1·5	"	−·921	−·991	+ ·389	+3·21

whence the normal equations:—

$$
\begin{aligned}
18.500x + 3.338y - .773z - .091u - 5.148 &= 0 \\
9.927y - 1.617z + .232u - 1.471 & \\
10.151z + .063u - 4.003 & \\
8.569u + 6.821 &
\end{aligned}
$$

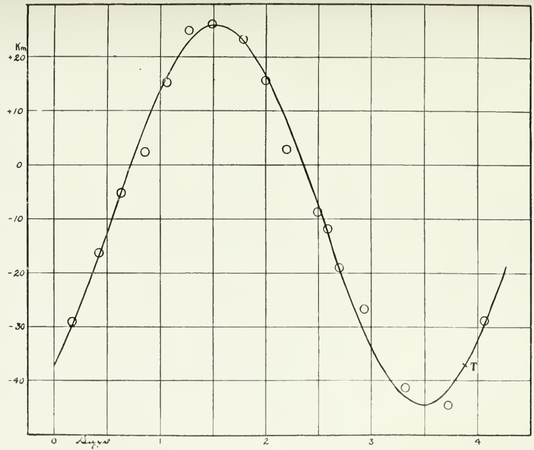


Fig. 6.—Velocity Curve of 7 Camelopardalis.

The following corrections resulted:—

$$\begin{aligned} \delta\gamma &= + \ \ .27 \text{ km.} \\ \delta K &= + \ \ .15 \ \ \text{“} \\ \delta e &= + \ .013 \\ \delta\omega &= -1^\circ.31 \end{aligned}$$

so that the final values with their probable errors are the following:—

$$\begin{aligned} P &= 3.8846 \text{ days} \\ e &= .013 \pm .020 \\ \omega &= 217^\circ.14 \pm 1^\circ.20 \\ K &= 35.15 \text{ km.} \pm .72 \text{ km.} \\ \gamma &= -8.93 \text{ km.} \pm .51 \text{ km.} \\ T &= \text{J. D. } 2418281.176 \\ A &= 34.79 \text{ km.} \\ B &= 35.51 \text{ km.} \\ a \sin i &= 1{,}877{,}000 \text{ km.} \end{aligned}$$

The sum of the squares of the residuals for the normal places was reduced from 77.6 to 68.5 and satisfactory agreement was obtained between equation and ephemeris residuals, the greatest difference being 0.03 km. The probable error of a plate obtained from columns six and seven of the table of measures is ± 2.18 km. per sec.

The curve shown (Fig. 6) represents the final elements.

While the irregularity in the curve is still noticeable, the three normal places which show it most have weights below the average and the peculiar trend of the residuals might be treated as accidental. The writer, however, is rather inclined to believe that the second spectrum is present, and, though faint, has sufficient influence on the measures to account for the deviations shown.

o Andromedae.

This star (α 22^h 57^m.3, δ 41°47′, photographic magnitude 3.4, type B3) was announced by Wright in 1902 as a spectroscopic binary from four plates, viz.:—

1900.	Oct. 9	—	11.
	Dec. 17	—	16.
1901.	June 25	—	20.
	Aug. 12	—	12.

The measures were based on the excellent $H\gamma$ line, but mention was made of the composite nature of the spectrum.

Fifty plates of the star were secured here in 1906 and 1907, and it was then abandoned until such time as an instrument more suitable for photographing its spectrum was available. The first sixteen plates were made with the Universal three-prism spectrograph and the measures depended solely on $H\gamma$, which was a good line. With the exception of two, numbers 999 and 1002, which were made with the three-prism instrument, III L, all the rest were secured with single-prism dispersion, the spectrograms showing H_β, H_γ, H_δ and occasionally H_ϵ as measurable lines. The K line of calcium was noted on a few of the latter plates, but, owing to its poor quality it could not be stated definitely whether the velocity given by it agreed with that of the hydrogen lines. The data of the plates and detailed measures of all but the first sixteen are appended.

P—Plaskett.
H—Harper.
T—Tribble.

RECORD OF SPECTROGRAMS

Star.	No. of Neg.	Camera	Plate.	Date.	Middle of Exposure. G.M.T.	Duration	Hour Angle at End.	Temperature. Room. Beg.	Temperature. Room. End.	Temperature. Prism Box. Beg.	Temperature. Prism Box. End.	Slit Width in Inches.	Seeing.	Observer	Remarks.
					h m	m	h m	Fahrenheit.		Centigrade.					
o Andromedæ	369	U	Seed 27	1906 Aug. 6	19 10	70	0 43 W	69·4	68·8	28·0	27·9	·001	Good	..	
"	374	"	"	" 8	19 30	65	1 10 W	71·6	70·2	28·3	28·1	"	"	..	
"	379	"	"	" 15	18 35	60	0 40 W	63·3	59·8	24·9	24·9	"	"	H	
"	401	"	"	Sept. 27	16 38	60	1 30 W	57·3	55·0	21·8	21·5	"	"	H	
"	410	"	"	Oct. 16	17 05	70	3 20 W	54·7	53·8	17·6	17·6	"	"	H	
"	414	"	"	" 23	15 17	75	2 00 W	46·0	44·1	15·4	15·2	"	"	H	
"	419	"	"	Nov. 1	17 40	60	4 55 W	34·0	33·5	7·7	7·8	"	"	H	
"	432	"	"	" 8	17 05	60	4 45 W	35·4	34·0	9·6	9·8	"	"	H	
"	439	"	"	" 19	14 30	55	2 50 W	40·4	38·0	10·0	10·1	·0013	Fair	H	
"	450	"	"	Dec. 11	12 43	43	2 23 W	16·0	14·0	− 3·5	− 3·7	"	Good	H	
"	460	"	"	" 13	14 40	30	4 12 W	20·5	20·0	− 0·5	− 0·5	·0014	....	H	
"	482	"	"	" 18	11 04	42	1 05 W	17·3	16·3	− 1·9	− 2·1	"	....	H	
"	491	"	"	" 19	12 52	45	3 05 W	14·0	13·8	− 7·5	− 7·4	"	....	P	
"	526	"	"	1907 Jan. 11	13 20	30	5 00 W	19·6	17·5	− 8·0	− 7·9	.0015	Good	P	
"	531	"	"	" 15	11 20	40	3 15 W	6·3	5·5	−12·8	−12·8	"	....	H	
"	538	"	"	" 16	14 25	50	6 35 W	− 1·0	− 2·0	−17·9	−17·8	"	....	P	
								Centigrade.							
"	855	I L	"	June 14	20 07	25	2 15 E	18·3	17·6	23·0	23·0	·0012	Good	P	
"	867	"	"	" 20	19 34	35	2 15 E	19·0	18·8	25·2	25·2	"	Hazy	H	
"	874	"	"	" 21	20 00	30	1 30 E	21·6	21·0	29·0	29·0	·0013	....	P	
"	899	"	"	" 27	19 42	35	1 45 E	18·6	18·6	24·5	24·5	·0014	Good	H	
"	907	"	"	July 2	19 53	33	1 10 E	13·5	12·5	17·0	16·8	"	"	H	
"	935	"	"	" 9	19 39	31	0 58 E	19·0	18·0	25·0	25·0	"	"	H	
"	948	"	"	" 16	18 27	34	1 42 E	23·0	22·5	26·6	26·6	"	Fair	H	
"	954	"	"	" 18	17 54	31	2 08 E	22·0	22·0	28·4	28·4	·0012	....	H	
"	960	"	"	" 20	18 55	30	1 00 E	17·2	17·6	21·4	21·4	"	....	P	
"	970	"	"	" 27	19 15	38	0 00	19·4	19·2	22·3	22·3	"	....	P	
"	977	"	"	Aug. 1	18 37	36	0 29 E	20·0	19·3	24·8	25·0	"	Very hazy	T	
"	984	"	"	" 5	18 33	33	0 25 E	16·0	15·8	21·0	21·0	"	Cloudy	P	

"	999	HI L	"	"	8	18	17	85	0	05	W	17·5	16·5	25·1	25·0	·002	Poor	H	
"	1002	"	"	"	10	17	07	75	1	00	E	22·1	22·0	28·7	28·7	"	Fair	P	
"	1008	I L	"	"	12	17	57	34	0	25	E	21·5	20·5	29·0	29·0	"	....	H	
"	1021	"	"	"	22	18	41	37	1	00	W	16·2	16·0	24·0	24·0	·0014	Hazy	H	
"	1035	"	"	Sept.	6	16	49	46	0	07	W	17·5	16·2	20·5	20·5	·0012	"	T	
"	1042	"	"	"	12	19	45	65	3	40	W	14·0	14·0	20·6	20·6	·0014	Poor	H	
"	1044	"	"	"	14	18	50	50	2	45	W	19·0	19·2	20·8	20·8	·0011	"	P	
"	1052	"	"	"	18	17	02	40	1	07	W	10·4	10·4	17·0	17·0	·0014	Good	T	
"	1053	"	"	"	"	17	46	43	1	52	W	10·4	11·0	"	"	"	"	T	
"	1065	"	"	"	20	17	20	35	1	30	W	21·0	20·5	22·6	22·6	"	Fair	H	
"	1066	"	"	"	"	18	00	41	2	13	W	20·5	20·0	22·6	"	"	Good	H-T	
"	1087	"	"	Oct.	1	16	05	30	0	56	W	9·0	7·5	14·1	14·0	"	....	H	
"	1088	"	"	"	"	16	36	30	1	30	W	7·5	7·0	14·0	13·9	"	....	H	
"	1130	"	"	Nov.	8	15	30	60	3	05	W	4·6	4·0	5·8	5·7	·0012	Steady	P	Cloudy.
"	1131	"	"	"	"	16	20	35	3	45	W	4·0	3·6	5·7	5·6	"	Fair	P	
"	1133	"	"	"	11	15	00	30	2	30	W	0·0	− 0·2	5·7	5·6	·001	"	P	
"	1134	"	"	"	"	15	32	20	3	00	W	− 0·4	− 0·7	5·6	"	·0014	"	P	
"	1151	"	"	"	18	13	52	40	2	00	W	3·9	3·6	5·0	5·0	·0013	Hazy	P	
"	1152	"	"	"	"	14	50	60	3	05	W	3·6	3·3	"	"	"	"	P	
"	1174	"	"	Dec.	4	15	35	35	4	41	W	−10·5	−12·5	1·0	1·0	·0015	Good	H	
"	1175	"	"	"	"	16	10	30	5	15	W	−12·5	−11·0	"	"	"	"	H	
"	1176	"	"	"	"	16	44	32	5	30	W	−11·0	−12·0	"	0·6	"	"	H	

DETAILED MEASURES OF ο ANDROMEDÆ

λ	855.		867.		874.		899.		907.		926.		935.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527......	−27·2	3	−27·2	2	−45·6	2	−30·1	2	−25·6	2	......	....	−28·6	2
4340·634......	36·7	2	21·7	2	31·0	2	37·4	2	23·1	2	−44·7	1	32·6	2
4102·000......	31·5	1½	−35·9	1	−21·7	1½	−49·3	1½	−30·8	1	......	....	−27·0	1½
3970·177......	−35·7	½	......	....	......	....	......	....	......	....	......	....	......	....
Weighted Mean.......	−32·29		−26·72		−33·76		−37·96		−25·65		−44·71		−29·62	
V_a	+20·55		+20·94		+20·99		+21·14		+21·09		+20·85		+20·79	
V_d	+ ·15		+ ·15		+ ·11		+ ·12		+ ·10		+ ·08		+ ·08	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity.	−12·9		− 5·9		−12·9		−17·0		− 4·7		−24·1		− 9·0	

DETAILED MEASURES OF ο ANDROMEDÆ—(Continued).

λ	948.		954.		960.		964.		970.		977.		984.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527......	−28·1	2	−53·1	1	−34·9	2	......	....	−26·6	2	−19·3	½	−33·4	2
4340·634......	31·0	1½	37·9	2	18·8	2	−61·7	1	−31·9	2	−10·0	1½	34·0	2
4102·000......	−33·1	1½	−36·7	1½	−35·2	1½	−54·8	½	......	....	......	....	−35·0	1½
Weighted Mean......	−30·48		−39·55		−30·17		−59·41		−29·24		−12·29		−34·09	
V_a	+20·20		+19·98		+19·73		+19·33		+18·70		+17·81		+16·98	
V_d	+ ·12		+ ·15		+ ·08		+ ·12		+ ·02		+ ·05		+ ·05	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	−10·4		−19·7		−20·6		−40·2		−10·8		+ 5·3		−17·3	

DETAILED MEASURES OF o ANDROMEDÆ—(Continued).

λ	999.		1002.		1008.		1021.		1035.		1042.		1044.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527......	−55·5	½	−16·5	1	−46·0	1¼	−38·8	½	−17·6	1	−28·0	½	−14·1	2
4340·634......	−32·4	1½	−31·6	2	36·5	2	40·1	2	21·5	2	−21·2	1½	5·8	2½
4102.000......	......	......	......	....	−45·1	¼	−57·6	½	−25·8	1	......	....	31·9	1
3970·177......	......	......	......	....	......	......	......	....	......	....	......	....	19·3	½
Weighted Mean.......	−38·20		−26·56		−40·50		−42·81		−21·58		−22·95		−14·05	
V_a	+16·35		+15·91		+15·40		+12·73		+ 8·07		+ 5·97		+ 5·25	
V_d	+ ·03		+ ·10		+ ·05		− ·05		+ ·01		− ·20		− ·13	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	−22·1		−10·9		−24·9		−30·4		−13·8		−17·5		− 9·2	

DETAILED MEASURES OF o ANDROMEDÆ—(Continued).

λ	1052.		1053.		1065.		1066.		1087.		1088.		1130.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527......	......	......	......	....	−27·4	1	−22·9	½	−20·9	½	− 3·9	2	+13·9	1
4340·634......	−13·6	2½	−26·0	2½	−19·5	3	8·2	1½	−13·0	1	1·4	2	12·5	2
4102·000......	−22·9	1	−37·2	½	+ 2·9	½	−24·4	½	......	....	−16·3	1	+ 1·7	1½
Weighted Mean......	−16·24		−27·87		−18·80		−14·41		−15·66		− 5·39		+ 9·24	
V_a	+ 3·72		+ 3·72		+ 3·10		+ 3·10		− 0·85		− 0·85		−13·92	
V_d	− ·05		− ·10		− ·08		− ·12		− ·05		− ·05		− ·23	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	−12·8		−24·5		−16·1		−11·7		−16·8		− 6·6		− 5·2	

DETAILED MEASURES OF o ANDROMEDÆ—(Continued).

λ	1131.		1133.		1134.		1151.		1152.		1174.		1175.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527......	−11·3	2	+16·0	3	− 0·4	2½	+ 5·4	1½	+ 7·1	1½	+12·5	1	+ 2·9	1
4340·634......	+ 8·3	2	+21·4	2	− 7·9	2	+21·6	1½	+12·2	1½	+14·3	1½	+18·2	1
4102·000......	± 0·0	2	− 2·6	1½	− 7·5	1½	− 6·7	1	− 2·9	1	− 9·1	1	− 6·2	1
3970·177......	......	....	+10·5	½	± 0·0	½	......	....	......	....	−10·8	½	−18·5	½
Weighted Mean......	− 1·00		+13·15		− 4·33		+ 8·44		+ 6·50		+ 4·85		+ 1·61	
V_a	−13·92		−14·77		−14·77		−15·90		−15·90		−19·90		−19·90	
V_d	− ·25		− ·17		− ·22		− ·13		− ·19		− ·28		− ·30	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity.	−15·4		− 2·0		−19·6		− 7·9		− 9·9		−15·6		−18·7	

DETAILED MEASURES OF o ANDROMEDÆ—(Concluded).

λ	1176.													
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527......	+ 9·1	1	......	....	......	....	......	....	......	....	......	....	......	....
4340·634......	+14·2	1	......	....	......	....	......	....	......	....	......	....	......	....
4102·000......	− 0·2	1	......	....	......	....	......	....	......	....	......	....	......	....
3970·177......	−27·9	¼	......	....	......	....	......	....	......	....	......	....	......	....
Weighted Mean......	+ 4·98		....		....		....		....		....		....	
V_a	−19·90		....		....		....		....		....		....	
V_d	− ·31		....		....		....		....		....		....	
Curv.	− ·28		....		....		....		....		....		....	
Radial Velocity...	−15·5		....		....		....		....		....		....	

MEASURES OF o ANDROMEDÆ

Date.			Velocity.	Wt.	Date.			Velocity.	Wt.
1906.	Aug.	6......	− 4	2	1907.	July	27......	−11	4
	"	8......	− 1	2		Aug.	1......	+ 5	2
	"	15......	− 4	2		"	5......	−17	5½
	Sep.	27......	0	2		"	8......	−22	2
	Oct.	16......	− 8	2		"	10......	−11	3
	"	23......	− 2	3		"	12......	−25	3½
	Nov.	1......	−20	2		"	22......	−30	3
	"	8......	−11	2		Sep.	6......	−14	4
	"	19......	−13	2		"	12......	−17	2
	Dec.	11......	−10	2		"	14......	− 9	6
	"	13......	−15	2		"	18......	−13	3½
	"	18......	−24	2		"	18......	−24	3
	"	19......	−30	2		"	20......	−16	4½
1907.	Jan.	11......	−19	3		"	20......	−12	2½
	"	15......	−19	2		Oct.	1......	−17	1½
	"	16......	−13	1½		"	1......	− 7	5
	June	14......	−13	7		Nov.	8......	− 5	4½
	"	20......	− 6	5		"	8......	−15	6
	"	21......	−13	5½		"	11......	− 2	7
	"	27......	−17	5½		"	11......	−20	6½
	July	2......	− 5	5		"	18......	− 8	4
	"	9......	− 9	5½		"	18......	−10	4
	"	16......	−10	5		Dec.	4......	−16	4
	"	18......	−20	4½		"	4......	−19	3½
	"	20......	−21	5½		"	4......	−15	3

ϵ Cassiopeiæ.

This star ($\alpha = 1^h\ 48^m.0$, $\delta = +63°\ 11'$, photographic magnitude 3.5, type B5), was placed on our observing programme as one of those stars having sharp *H* and *K* lines; the presence of which in spectra having for the most part diffuse lines is sometimes considered as indicating the presence of a second body in the system.

Four plates had been secured at Yerkes Observatory and measured by Frost and Adams* as follows:—

			Adams.	Frost.
1901.	Oct.	3............	−7·1	−2·6
	"	23............	−5·8	−8·5
	"	25............	−7·6	−5·0
1902.	Aug.	27............	−4·3	−6·0

The mean of their plates, as well as of all their measures, was −5.9 km. per sec. The results of our first four plates were considerably different from this mean value, and when further plates showed a greater range it was considered that this star was very probably a spectroscopic binary. As the dependable range seemed quite small it was decided to make several plates on each night the star was observed, the mean of the night being used. In this way thirty-nine plates on Seed 27 Emulsion were made without giving any further proof of the reality of the variation, other than that some of them seemed to show a few lines as complex. Fine-grained plates of the Seed 23 Emulsion were then used in the hope of recording the

* Decennial Publications of University of Chicago, VIII., page 191.

spectrum of the second component if the star were really a spectroscopic binary. Sixteen such plates were secured without much additional evidence, and as a last resource the three-prism spectrograph was employed. Only a few plates have so far been made, but they do not show any definite doubling of the lines. A few plates from time to time will be made with the three-prism camera; in the meantime one cannot say with certainty whether or not this star is a spectroscopic binary.

The observational data for the plates and the detailed measures are given. After most of the plates had been measured, using every available line, a set of eight lines was chosen for velocity determination. For the same quality of a line the weight assigned the first season is somewhat higher than for the second.

These are the lines:—

Mg	4481·400	He	4143·928
He	4471·676	H	4101·890
He	4388·100	He	4026·352
H	4340·634	Ca	3933·825

RECORD OF SPECTROGRAMS

H—Harper.
P[1]—Parker.
C—Cannon.

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure. G.M.T.	Duration.	Hour Angle at End.	Temperature, Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width in Inches.	Seeing.	Observer.	Remarks.
				1909	h m	m	h m								
ε Cassiopeiæ	2623	I	Seed 27	July 6	19 14	32	4 20 E	16·5	14·2	25·1	24·5	·002	Good	C	
"	2644	"	"	" 9	20 22	30	3 00 E	15·0	14·6	25·3	25·1	"	"	C	
"	2693	"	"	" 30	19 45	20	2 23 E	19·4	19·0	24·8	24·8	"	5	C	
"	2788	"	"	Sept. 14	16 54	12	2 15 E	20·0	20·0	27·0	27·1	"	4	H	
"	2868	"	"	Oct. 8	15 06	19	2 27 E	19·5	18·0	22·9	22·9	"	5	H	Off 4^{m}.
"	2869	"	"	" "	15 25	16	2 10 E	18·0	17·5	"	"	"	5	H	
"	2937	"	"	Nov. 8	17 31	30	2 05 W	2·5	2·2	5·6	5·6	"	4–5	C	
"	2964	"	"	" 18	13 12	15	1 39 E	− 3·0	− 3·0	1·2	1·1	"	5	H	
"	2991	"	"	Dec. 1	12 43	13	1 20 E	1·8	1·5	6·6	6·5	"	4	P	
"	3021	"	"	" 10	14 49	18	1 25 W	− 5·5	− 5·5	− 3·6	− 3·6	"	2–3–4	H	
"	3022	"	"	" "	15 08	18	1 44 W	"	"	"	"	"	3–4	H	
"	3063	"	"	" 29	13 58	15	1 45 W	−16·0	−16·0	− 8·0	− 8·0	"	5	H	
"	3064	"	"	" "	14 17	20	2 05 W	"	"	"	"	"	4	H	
"	3065	"	"	" "	14 37	18	2 25 W	"	"	"	"	"	4–3	H	
				1910											
"	3090	"	"	Jan. 10	13 00	15	1 35 W	−13·5	−13·5	− 3·5	− 3·6	"	4–5	H	
"	3091	"	"	" "	13 16	15	1 51 W	"	"	− 3·6	"	"	"	H	
"	3092	"	"	" "	13 33	17	2 09 W	"	"	"	− 3·7	"	"	H	
"	3192	"	"	Feb. 18	11 57	15	3 05 W	− 8·0	− 8·5	− 2·5	− 2·5	"	"	H	
"	3193	"	"	" "	12 14	16	3 23 W	− 8·5	− 9·0	"	"	"	5	H	
"	3194	"	"	" "	12 32	16	3 40 W	− 9·0	−10·0	"	"	"	4	H	
"	3243	"	"	" 28	13 23	15		5·6	5·3	10·4	10·4	"	4	C	
"	3244	"	"	" "	13 39	15	5 30 W	5·3	5·2	"	"	"	4–5	C	
"	3245	"	"	" "	13 57	16		5·2	"	"	"	"	"	C	
"	3584	"	"	Aug. 19	21 08	10	0 15 W	21·7	21·7	13·1	13·0	"	4	P[1]	
"	3585	"	"	" "	21 22	16		21·7	21·8	13·0	12·9	"	4	P[1]	
"	3586	"	"	" "	21 38	14	0 45 W	21·8	"	12·9	12·8	"	4	P[1]	
"	3591	"	"	" 26	20 42	15	0 15 W	11·5	11·2	19·7	19·6	"	5	C	
"	3592	"	"	" "	20 58	15	0 31 W	11·2	"	19·6	"	"	5	C	
"	3593	"	"	" "	21 14	15	0 49 W	"	11·1	"	"	"	5	C	
"	3605	"	"	" 31	19 47	15	0 35 E	14·2	13·5	22·3	22·3	"	4	C	
"	3606	"	"	" "	20 03	14	0 20 E	13·5	"	"	"	"	4–5	C	

H—Harper.
P¹—Parker.
C—Cannon.

RECORD OF SPECTROGRAMS (Concluded).

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure. G.M.T.	Duration.	Hour Angle at End.	Temperature, Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width in Inches.	Seeing.	Observer.	Remarks.
				1910.	h m	m	h m								
ε Cassiopeiæ	3607	I	Seed 27	Aug. 31	20 18	14	0 05 E	13·5	13·5	22·3	22·3	·002	4	C	
"	3620	"	"	Sept. 7	20 07	15	0 30 W	14·2	14·0	19·8	19·8	"	4–5	C	
"	3621	"	"	" "	20 23	15	0 46 W	14·0	13·7	"	"	"	"	C	
"	3622	"	"	" "	20 40	15	1 03 W	13·7	13·6	"	"	"	"	C	
"	3647	"	"	" 14	19 02	15		11·0	10·7	16·7	16·7	"	"	C	
"	3648	"	"	" "	19 18	15		10·7	10·4	"	"	"	"	C	
"	3649	"	"	" "	19 32	11	0 25 W	10·4	10·2	"	"	"	"	C	
"	3655	"	"	" 15	19 33	12	0 25 W	10·0	9·7	14·9	14·8	"	5	H	
"	3656	"	Seed 23	" "	19 51	21		9·7	9·4	14·8	14·7	"	5	H	
"	3657	"	"	" "	20 15	23	1 12 W	9·4	9·2	14·7	"	"	5	H	
"	3684	"	"	" 21	19 50	20	1 10 W	5·4	4·8	16·3	16·4	"	4–5	C	
"	3685	"	"	" "	20 11	20	1 31 W	4·8	5·0	16·4	"	"	"	C	
"	3686	"	"	" "	20 32	20	1 52 W	5·0	4·8	"	"	"	"	C	
"	3699	"	"	" 28	18 51	20	0 37 W	9·0	8·9	17·7	17·7	"	"	C	
"	3700	"	"	" "	19 12	20	0 58 W	8·9	8·8	"	"	"	"	C	
"	3701	"	"	" "	19 35	25	1 19 W	8·8	8·6	"	"	"	"	C	
"	3717	"	"	Oct. 7	17 55	20	0 25 W	7·0	5·2	18·3	18·2	"	5	P¹	
"	3718	"	"	" "	18 16	21	0 47 W	5·2	"	18·2	"	"	5	P¹	
"	3719	"	"	" "	18 41	24	1 15 W	"	3·5	"	18·1	"	5	P¹	
"	3735	"	"	" 12	16 42	20	0 40 E	1·5	1·3	10·2	10·1	"	5	P¹	
"	3736	"	"	" "	17 03	20	0 19 E	1·3	"	10·1	"	"	5	P¹	
"	3737	"	"	" "	17 24	21	0 05 W	"	1·2	"	"	"	5	C	
"	3748	"	"	" 17	17 36	24	0 40 W	8·1	8·0	17·4	17·4	"	4–0	P¹	
"	3749	"	"	" "	18 19	60	1 40 W	8·0	"	"	"	"	2	P¹	

DETAILED MEASURES OF ε CASSIOPEIÆ

λ	2623.		2623.		2644.		2693.		2788.		2868.		2869.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	−24·0	1	−27·5	1	−38·5	1½	−22·9	½	......	....	−28·7	¼	−14·4	½
4471	34·1	1½	34·4	1½	36·0	1	13·5	½	−35·6	1	1·9	½	......	....
4388	48·7	1	43·3	1	38·1	1	......	....	......	....	......	....	......	....
4340	25·8	2	28·5	2	38·9	2	35·2	1½	24·7	1½	13·3	1	13·4	1
4143	50·2	1	45·0	1	......	....	31·1	1	......	....	20·5	¾	22·3	½
4101	32·6	1	28·3	1½	40·3	2	15·7	1	54·5	½	25·0	1	2·9	¾
4026	31·3	1	20·7	1	26·6	1	47·6	1½	−32·2	2	22·2	¾	−19·9	¾
3933	−17·9	2	−12·2	1½	−16·0	2	−40·4	1	......	....	−18·0	1	......	....
Weighted Mean	−30·98		−29·12		−33·22		−32·80		−32·86		−18·37		−13·96	
V_a	+15·37		+15·37		+15·99		+19·05		+17·46		+12·22		+12·22	
V_d	+ ·10		+ ·10		+ ·10		+ ·06		+ ·11		+ ·12		+ ·11	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−15·8		−13·9		−17·4		−14·0		−15·6		− 6·3		− 1·9	

DETAILED MEASURES OF ε CASSIOPEIÆ—(Continued).

λ	2937.		2937.		2964.		2991.		3021.		3022.		3063.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	......	....	......	....	− 9·0	½	+11·5	1	......	....	+ 5·1	¾	......	....
4471	......	....	......	....	+19·5	¾	......	....	......	....	+ 8·1	½	......	....
4388	......	....	......	....	......	....	......	....	......	....	− 9·9	¾	+ 2·4	½
4340	+ 0·9	1½	± 0·0	1½	+ 2·1	1¼	+14·9	1½	− 7·7	¾	− 8·1	1	− 2·0	¾
4143	......	....	......	....	+16·8	1	+ 7·9	1	9·6	½	......	....	− 6·6	¾
4101	−19·6	1	−16·8	1	− 4·1	¾	+ 1·2	½	5·2	1¼	+ 6·9	½	+ 6·2	1
4026	−24·4	1	−16·3	1	−19·9	1	− 1·2	1½	− 8·8	½	+ 9·0	1½	......	....
3933	+ 1·7	1	+ 0·5	1	......	....	− 1·2	1½	......	....	......	....	+10·8	½
Weighted Mean	− 9·11		− 7·24		+ 1·25		+ 5·53		− 7·19		+ 1·88		+ 1·82	
V_a	+ 2·31		+ 2·31		− 1·16		− 5·69		− 8·73		− 8·73		−14·28	
V_d	− ·11		− ·11		+ ·11		+ ·09		− ·04		− ·05		− ·13	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 7·2		− 5·3		− 0·1		− 0·3		−16·2		− 7·2		−12·9	

DETAILED MEASURES OF ε CASSIOPEIÆ—(Continued).

λ	3064.		3065.		3065.		3090.		3091.		3092.		3192.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	.....	...	.....	...	− 3·8	½	.....	...	− 3·7	1	+11·1	½	.....	...
4471	+ 5·2	¾	− 1·2	½	+19·6	½	+12·7	1¼	+ 0·6	1¼	− 8·0	¾	.....	...
4388	.....	...	.....	...	.....	...	+12·0	1	+18·8	½	+29·7	¼	.....	...
4340	− 3·9	1	− 6·1	1	− 4·6	1	+17·3	¾	+10·8	1	+ 8·9	1¼	+16·4	½
4143	+17·1	¾	+ 8·6	1	+ 9·0	1	+19·9	½	− 7·5	½	− 3·7	¾	.....	...
4101	+12·5	1¼	−10·8	1	− 8·2	1	− 3·8	½	+25·9	¾	+21·2	½	15·3	1
4026	− 0·7	¾	+ 1·3	1	+ 2·1	1	− 2·9	½	+ 9·1	½	+15·8	1¼	+16·2	¾
3933	− 5·5	½	− 2·8	½	− 8·3	½	−13·3	½	.....	...	− 8·3	½	.....	...
Weighted Mean	+ 5·03		− 1·79		+ 0·38		+ 8·15		+ 6·81		+ 7·25		+15·84	
V_a	−14·28		−14·28		−14·28		−17·00		−17·00		−17·00		−20·24	
V_d	− ·09		− ·10		− ·10		− ·05		− ·07		− ·09		− ·11	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−10·4		−16·4		−15·0		− 9·2		−10·5		−10·1		− 4·8	

DETAILED MEASURES OF ε CASSIOPEIÆ—(Continued).

λ	3193.		3194.		3243.		3244.		3245.		3584.		3585.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	.....	...	.....	...	.....	...	.....	...	+ 5·0	¾	.....	...	.....	...
4471	.....	...	.....	...	+25·6	½	.....	...	22·1	½	.....	...	.....	...
4388	.....	...	.....	...	27·4	¾	.....	...	18·0	½	.....	...	.....	...
4340	+19·7	½	+11·6	½	15·0	2	+11·6	1	+12·7	1¼	−23·3	1	−16·3	¾
4143	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	23·7	½
4101	18·5	¾	+21·5	1	+26·4	¾	5·1	¾	.....	...	39·2	¾	35·5	¾
4026	+18·3	½	.....	...	.....	...	+12·6	1	.....	...	−36·5	½	29·3	¾
3933	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	−36·5	¾
Weighted Mean	+18·79		+18·18		+20·78		+10·18		+13·23		−31·53		−28·59	
V_a	−20·24		−20·24		−19·56		−19·56		−19·56		+19·82		+19·82	
V_d	− ·11		− ·12		− ·15		− ·15		− ·15		− ·01		− ·03	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 1·8		− 2·5		+ 0·8		− 9·8		− 6·8		−12·0		− 9·1	

DETAILED MEASURES OF ε CASSIOPEIÆ—(Continued).

λ	3586.		3591.		3592.		3593.		3605.		3606.		3607.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	......	...	......	...	−30·9	½	......	...	......	...	......	...	−28·7	1
4471	......	...	......	...	33.0	½	......	...	......	...	......	...	......	...
4388	......	...	......	...	53·6	½	......	...	−45·8	¾	......	...	......	...
4340	−27·1	1	−31·4	½	34·6	¾	−34·6	¾	27·7	½	−30·7	½	−11·8	1½
4143	......	...	......	...	......	...	......	...	......	...	......	...	......	...
4101	25·3	1½	39·4	¾	25·0	¾	......	...	−14·9	¾	−24·0	½	......	...
4026	31·3	1	−31·3	¾	−14·4	¼	−49·0	¼	......	...	......	...	......	...
3933	−25·0	½	......	...	......	...	......	...	......	...	......	...	......	...
Weighted Mean	−27·21		−34·36		−33·00		−38·20		−29·70		−27·35		−18·93	
V_a	+19·82		+19·56		+19·56		+19·56		+19·21		+19·21		+19·21	
V_d	− ·04		·00		− ·03		− ·04		+ ·04		+ ·03		+ ·01	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 7·7		−15·1		−13·8		−19·0		−10·7		− 8·4		± 0·0	

DETAILED MEASURES OF ε CASSIOPEIÆ—(Continued).

λ	3620.		3621.		3622.		3647.		3648.		3649.		3655.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4471	−16·9	½	......	...	......	...	−12·6	½	−16·4	½	−31·1	½	−21·1	½
4340	20·4	1	−29·3	¾	−36·1	1	16·5	½	5·0	½	29·2	½	17·3	¾
4143	......	...	31·6	½	......	...	......	...	24·2	½	......	...	......	...
4101	......	...	34·4	¼	31·0	½	42·7	½	34·8	½	31·7	1	34·3	¾
4026	−20·0	½	−18·8	½	−31·3	¾	35·0	½	−40·3	½	−23·0	½	−41·9	½
3933	......	...	......	...	......	...	−31·7	¼	......	...	......	...	......	...
Weighted Mean	−19·45		−27·90		−33·40		−27·25		−24·14		−29·32		−28·09	
V_a	+18·48		+18·48		+18·48		+17·48		+17·48		+17·48		+17·31	
V_d	− ·02		− ·03		− ·04		·00		·00		− ·02		− ·02	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 1·3		− 9·7		−15·2		−10·0		− 6·9		−12·2		−11·1	

DETAILED MEASURES OF ε CASSIOPEIÆ—(Continued).

λ	3656.		3657.		3684.		3685.		3686.		3699.		3700.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	......	....	......	....	−23·3	½	−32·3	½	−26·2	¼	......	....	......	....
4471	−18·1	1	−19·6	¾	29·4	½	15·9	½	31·2	½	......	....	−13·9	¾
4388	23·5	½	......	....	17·2	½	25·0	1	20·8	1	−32·6	¼	26·3	½
4340	5·3	1½	18·9	1	42·1	½	19·6	¾	25·7	1½	29·3	½	−11·5	1
4143	20·7	½	......	....	......	....	14·6	½	......	....	......	....	......	....
4101	20·2	½	−19·9	1	......	....	16·5	½	......	....	−26·9	½	......	....
4026	10·2	½	......	....	−33·8	½	−17·6	¾	−19·8	1	......	....	......	....
3933	−12·6	1	......	....	......	....	......	....	......	....	......	....	......	....
Weighted Mean	−13·81		−19·35		−29·16		−20·50		−23·84		−28·99		−15·60	
V_a	+17·31		+17·31		+16·22		+16·22		+16·22		+14·74		+14·74	
V_d	− ·04		− ·03		− ·03		− ·04		− ·07		− ·03		− ·03	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 3·2		− 2·6		−13·2		− 4·6		− 8·0		−14·6		− 1·2	

DETAILED MEASURES OF ε CASSIOPEIÆ—(Continued).

λ	3701.		3717.		3718.		3719.		3735.		3736.		3737.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	......	....	−28·0	½	−25·8	½	−18·4	¾	− 5·5	¾	− 0·0	½	−13·2	½
4471	......	....	30·0	¾	22·4	¾	25·3	1	+ 3·2	1	2·5	½	16·0	½
4388	......	....	32·8	½	24·1	½	27·0	¾	−12·9	½	14·2	½	16·0	½
4340	−23·0	½	−43·4	¾	−30·5	¾	−31·2	½	−21·3	¾	35·8	¾	23·4	¾
4143	......	....	......	....	......	....	......	....	......	....	14·9	½	16·9	½
4101	20·2	¼	......	....	......	....	......	....	......	....	− 9·2	¾	45·1	½
4026	−28·4	¼	......	....	......	....	......	....	−12·2	¾	......	....	− 8·6	½
3933	......	....	......	....	......	....	......	....	−12·9	½	......	....	......	....
Weighted Mean	−23·63		−34·18		−25·84		−25·00		− 9·16		−14·14		−20·12	
V_a	+14·74		+12·51		+12·51		+12·51		+11·14		+11·14		+11·14	
V_d	− ·04		− ·01		− ·03		− ·04		+ ·04		+ ·03		− ·01	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 9·2		−22·0		−13·6		−12·8		+ 1·7		− 3·2		− 9·3	

DETAILED MEASURES OF ε CASSIOPEIÆ—(Concluded).

λ	3748.		3749.											
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	−17·8	½												
4471	8·8	½	− 6·1	¾										
4388	17·3	½												
4340	15·0	¾	−18·5	½										
4143	26·5	¼												
4101	−12·5	¼												
Weighted Mean	−15·62		−11·04											
V_a	+ 9·65		+ 9·65											
V_d	− ·03		− ·04											
Curv.	− ·28		− ·28											
Radial Velocity	− 6·3		− 1·7											

MEASURES OF ε CASSIOPEIÆ

Date.			Velocity.	Line.	Date.			Velocity.	Line.
1909.	July	6	−15·	8	1910.	Aug.	26	−19·	2
	"	9	−17·	7		"	31	−11·	3
	"	30	−14·	7		"	31	− 8·	2
	Sep.	4	−16·	4		"	31	0·	2
	Oct.	8	− 6·	7		Sep.	7	− 1·	3
	"	8	− 2·	5		"	7	−10·	4
	Nov.	8	− 6·	4		"	7	−15·	3
	"	18	0·	6		"	14	−10·	5
	Dec.	1	0·	6		"	14	− 7·	5
	"	10	−16·	4		"	14	−12·	4
	"	10	− 7·	6		"	15	−11·	4
	"	29	−13·	5		"	15	+ 3·	7
	"	29	−10·	6		"	15	− 3·	3
	"	29	−16·	6		"	21	−13·	5
1910.	Jan.	10	− 9·	7		"	21	− 5·	7
	"	10	−10·	7		"	21	− 8·	5
	"	10	−10·	8		"	28	−15·	3
	Feb.	18	− 5·	3		"	28	− 1·	3
	"	18	− 2·	3		"	28	− 9·	3
	"	18	− 2·	2		Oct.	7	−22·	4
	"	28	+ 1·	4		"	7	−14·	4
	"	28	−10·	3		"	7	−13·	4
	"	28	− 7·	4		"	12	+ 2·	6
	Aug.	19	−12·	3		"	12	− 3·	6
	"	19	− 9·	5		"	12	− 9·	7
	"	19	− 8·	4		"	17	− 6·	6
	"	26	−15·	3		"	17	− 2·	2
	"	26	−14·	6					

MISCELLANEOUS.

The following measures of miscellaneous plates of the stars μ Orionis, ϵ Ursæ Majoris, ϕ Ursæ Majoris and π^8 Virginis are published. The plates are not as good as would be obtained when once the right exposure had been determined, but the measures may serve a purpose to other observers engaged in determining their orbits. I believe Professor Frost of the Yerkes Observatory is working on μ Orionis at present.

μ ORIONIS

Plate 1139 taken 1907, Nov. 11, G. M. T. 21^h 10^m
" 1159 " " " 23 " 18 03

Line.	1139.		1159.	
	Vel.	Wt.	Vel.	Wt.
4861·527	+43·1	1	+44·8	2
4549·766	57·3	1½	27·9	1½
4481·400	61·8	1½	44·9	2
4395·286	39·0	1	26·0	1½
4352·006	40·7	1½	45·0	2
4340·634	53·7	1½	44·1	2
4325·939	45·2	1	24·0	1½
4315·178	36·1	1½	19·5	1
4271·760	56·3	1½	43·9	1
4260·640	54·1	1	46·0	1½
4233·328	55·4	1	40·7	1½
4215·897	+53·8	2	+25·4	2
Weighted Mean	+50·19		+36·86	
V_a	+18·65		+13·70	
V_d	− ·12		+ ·07	
Curv	− ·28		− ·28	
Radial Velocity	+68·4		+50·3	

ϵ URSÆ MAJORIS

Plate 456 taken 1906, Dec. 11, G. M. T. 17^h 06^m
" 489 " " " 18 " 16 26

Line.	456.		489.	
	Vel.	Wt.	Vel.	Wt.
4584·018	....	....	−25·7	1
4558·827	−26·7	2	17·4	1
4549·642	2·1	2	25·2	2
4522·855	39·1	1	....	....
4515·508	14·5	3	13·9	1
4501·448	13·0	2	....	....
4481·400	21·1	3	20·1	3
4340·634	....	....	−33·4	2
4233·328	−13·2	1	....	....
Weighted Mean	−17·33		−23·45	
V_a	+17·25		+16·68	
V_d	+ ·15		+ ·15	
Curv	− ·50		− ·50	
Radial Velocity	− 0·4		− 7·0	

φ URSÆ MAJORIS

Plate taken 1908, April 13, G. M. T. 17h 22m

Line.	Velocity.	Weight.
4549·766	+ 7·3	2
4481·400	5·6	2
4325·939	9·9	2
4308·081	29·3	1½
4271·760	15·4	2
4246·996	16·5	1
4063·756	13·4	1
4045·975	+ 5·8	2

Weighted Mean.....	+11·99
V_a..............	−22·50
V_d..............	− ·18
Curv...........	− ·28
Radial Velocity..............	−11·0

π^3 VIRGINIS

Plate 3349 taken 1910, March 18, G. M. T. 20h 50m
" 3383 " " April 11 " 18 32

Line.	3349.		3383.	
	Vel.	Wt.	Vel.	Wt.
4584·018..................	−31·9	¼	....	....
4549·766..................	19·7	½	....	....
4481·400..................	−22·3	¾	−24·5	¾
4340·634..................	....	....	+ 0·8	1½
4143·928..................	....	....	− 9·5	¼
Weighted mean..........	−27·64		− 7·62	
V_a..................	− ·35		−12·10	
V_d..................	− ·26		− ·21	
Curv................	− ·28		− ·28	
Radial Velocity.........	−28·5		−20·2	

δ HERCULIS.

Thirty-seven plates of this star ($\alpha = 17^h\ 11^m$, $\delta = +24°\ 57'$) were made in the years 1907, 1908 and 1909, and from measures of some of the early plates it was announced as a spectroscopic binary. The spectrum is of A type but the hydrogen lines are unusually broad, often a width corresponding to 500 or 600 km. per sec., and hence a great deal of uncertainty is unavoidable in the results. The measures made on twenty-five plates run all the way from − 20 km. to − 80 km. per sec. but a considerable portion of this range, though not all, may be ascribed to accidental error of setting on such diffuse lines. Consequently the star was dropped from our programme for the time being.

APPENDIX B.

THE ELEMENTS OF 93 LEONIS, MEASURES OF ι CYGNI, α OPHIUCHI, σ CASSIOPEIÆ, AND 9 CAMELOPARDALIS.

J. B. CANNON, M.A.

THE ELEMENTS OF 93 LEONIS.

The star 93 Leonis, ($\alpha = 11^h\ 43^m$, $\delta = +\ 20°\ 46'$) was announced to be a binary by Campbell and Wright in 1900* from the measures of four plates taken by them in that year. It belongs to the group F8 of Miss Cannon's classification. It was under observation here at three different periods in the years 1908, 1909 and 1910. During that time seventy-two plates were taken, the instruments used being the old and new single-prism spectrographs.

The lines are not at all well defined and in many cases large differences result between the velocities given by the various lines and the mean of the plate. The lines appearing are chiefly due to Iron, Hydrogen, Magnesium, Titanium and Carbon. Several lines of each element were measured, but in the determination of the elements the Titanium lines were discarded, as so great differences between the velocities from its various lines existed that no dependence could be placed on them. A list follows giving the wave-lengths of the lines used and the element to which each is due:—

Wave-Length.	Element.	Wave-Length.	Element.
4861·527	H	4260·640	C
4549·766	Fe	4250·616	Fe
4481·400	Mg.	4227·010	Fe
4415·301	Fe	4216·351	Fe
4404·927	Fe	4101·890	H
4352·006	Mg. Cr.	4071·901	Fe
4340·634	H	4063·756	Fe
4325·939	Fe	4045·975	Fe
4271·760	Fe	3933·825	Ca

The period of oscillation was determined by the aid of the results obtained by Campbell and Wright from their measures of 1900 and found to be 71.70 days. This was taken as being close enough, their observations being some forty periods away from the date of the first plate obtained here.

At the maximum of the curve the determination was somewhat unsatisfactory, the weather unfortunately being very bad at each return of the star to that part of the curve so that only a few observations were obtained. Sometime later a few plates may be taken to verify the results accepted.

The record of the observations made and the detailed measures obtained will now be given followed by a summary giving the plate number, the Julian date, the phase, the accepted velocity, the weight and the residuals obtained from the two methods of measurement.

* Astrophysical Journal, 12, 255, 1900.

P—Plaskett.
H—Harper.
P¹—Parker.
C—Cannon.

RECORD OF SPECTROGRAMS

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at End.	Temperature. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1908	h m	m	h m								
93 Leonis...	1341	II.	Seed 27	Feb. 21	20 11	60	1 54 W	− 5·5	− 6·5	0·7	0·6	·0013	Hazy ½ time	H	
"	1356	"	"	" 24	17 39	32	25 E	−14·8	−14·6	− 2·3	− 2·3	"	Fair	P	
"	1381	"	"	Mar. 4	19 52	45	2 15 W	− 9·5	−10·0	+ 0·7	+ 0·7	"	....	P	
"	1388	"	"	" 9	18 27	45	1 22 W	− 9·5	−11·5	1·0	1·0	"	Fairly good	H	
"	1398	"	"	" 16	19 00	50	2 15 W	−10·0	−12·0	2·3	2·3	·0014	Good	H	
"	1498	"	"	April 17	13 40	40	1 00 E	7·0	6·6	10·9	10·8	·0015	Fair	P	
"	1534	"	"	May 18	13 55	50	1 20 W	21·5	20·5	24·3	23·9	·0016	Good	P	
"	1562	"	"	June 1	14 15	70	2 45 W	19·7	18·5	21·5	21·5	·0015	Poor	P	
"	1599	"	"	" 12	15 02	75	4 20 W	21·5	20·0	25·1	25·1	·0017	Good	H	
"	1627	"	"	" 24	14 25	90	4 30 W	23·5	21·6	28·0	27·5	·0015	Fair	P	
"	2022	"	"	Dec. 9	23 32	56	15 W	−20·0	−20·0	− 2·0	− 1·8	"	"	C	
"	2062	"	"	" 21	21 19	62	55 W	−14·5	−15·5	− 2·0	− 2·0	"	Good	C	
				1909											
"	2100	"	"	Jan. 6	22 29	67	1 25 W	−19·8	−20·0	− 3·3	− 3·2	"	Good	C	
"	2134	"	"	" 13	20 08	60	35 E	−16·4	−17·2	−12·2	−12·4	·0016	Fair	C	
"	2231	"	"	Feb. 3	18 08	65	1 10 E	−13·5	−12·0	− 3·9	− 4·0	"	"	C	
"	2262	"	"	" 8	21 05	70	2 10 W	−17·5	−19·0	− 5·5	− 5·3	"	"	H	
"	2300	"	"	" 22	19 45	60	1 40 W	− 5·4	− 5·4	1·0	0·8	"	"	C	
"	2341	I	"	Mar. 8	18 47	65	1 40 W	− 6·0	− 8·0	3·2	3·8	·002	Good	H	
"	2355	"	"	" 12	17 51	49	50 W	− 0·6	− 1·4	2·2	2·0	"	"	C	
"	2381	"	"	" 15	17 21	51	40 W	− 4·3	− 4·5	− 0·4	− 0·6	"	"	P¹	
"	2437	"	"	" 29	15 43	73	00	3·5	......	5·6	......	"	Poor	P¹	
"	2448	"	"	" 31	16 52	50	1 07 W	6·0	2·0	9·5	9·6	"	....	H	
"	2469	"	"	Apr. 1	20 23	64	4 50 W	− 1·5	− 1·5	8·2	8·3	"	Very hazy	P¹	
"	2481	"	"	" 8	16 05	70	1 00 W	4·0	3·0	8·0	8·0	"	Fair	P	
"	2501	"	"	" 19	18 12	55	4 00 W	3·2	2·7	6·4	6·4	"	Fair	P¹	
"	2509	"	"	" 23	16 42	75	2 40 W	3·5	3·5	10·6	10·6	"	Good	C	
"	2521	"	"	" 26	17 51	120	4 25 W	4·8	3·5	9·3	9·3	"	Very poor	P¹	
"	2528	"	"	" 28	16 22	75	2 40 W	3·0	0·5	8·9	9·0	"	Good	H	
"	2536	"	"	May 3	14 46	58	1 15 W	6·9	5·0	7·9	7·9	"	"	P¹	
"	2548	"	"	" 24	14 20	50	2 10 W	20·0	17·0	22·65	22·75	"	Hazy	P	
"	2562	"	"	June 9	14 27	95	3 35 W	21·0	19·2	24·4	24·2	"	Fair to poor	P	

P—Plaskett.
H—Harper.
P—Parker.
C[1]—Cannon.

RECORD OF SPECTROGRAMS—(Concluded).

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at End.	Temperature. Room. Beg.	Temperature. Room. End.	Temperature. Prism Box. Beg.	Temperature. Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1909	h m	m	h m								
93 Leonis...	2582	I	W. & W	June 24	14 15	50	4 10 W	26·0	25·1	28·3	28·2	·002	Fair	P	
"	2586	"	Seed 27	" 25	13 47	55	3 35 W	23·5	22·5	26·7	26·7	"	Good	C	
"	2595	"	"	" 28	13 47	55	3 55 W	24·2	23·2	27·2	27·1	"	Fair	C	
"	2604	"	W. & W	" 30	14 05	80	4 32 W	28·0	26·0	30·0	29·9	"	Hazy	H	
"	2633	"	Seed 27	July 8	14 00	62	4 45 W	21·0	21·0	24·8	24·4	"	Good	H	
"	2637	"	"	" 9	13 45	60	4 40 W	22·2	20·2	26·0	25·9	·0018	Fair	C	
"	2645	"	"	" 13	13 39	53	5 00 W	21·2	20·5	24·4	24·3	·002	Good	C	
"	2665	"	"	" 20	13 45	60	5 20 W	22·0	21·2	26·1	26·0	"	Hazy	C	
"	2700	"	"	Aug. 2	13 39	60	6 07 W	24·5	24·0	26·3	26·3	"	3–4	H	
"	2929	"	"	Oct. 29	22 35	50	3 10 E	− 1·8	− 1·9	5·6	5·8	·0017	5–3	P[1]	
				1910											
"	3116	"	"	Jan. 14	23 21	68	2 45 W	−16·5	−16·8	− 8·3	− 9·4	·002	5–3	P[1]	
"	3145	"	"	" 25	20 57	47	55 W	− 7·8	− 8·5	− 3·4	− 3·4	"	3	P	
"	3162	"	"	" 31	18 35	75	52 E	−10·0	−10·5	1·5	1·5	"	5–3–4	H	
"	3199	"	"	Feb. 18	18 17	141	25 W	−15·3	−17·5	− 2·8	− 3·8	"	.....	H	
"	3211	"	"	" 23	16 26	60	1 35 E	−13·0	−14·1	− 4·5	− 4·6	"	5	P[1]	
"	3249	"	"	" 28	17 34	52	15 E	2·3	2·0	9·2	9·4	"	4–5	C	
"	3257	"	"	Mar. 2	17 43	63	10 W	0·5	0·3	10·6	10·6	"	5–4–2	P[1]	
"	3271	"	"	" 3	16 22	65	1 05 E	0·2	0·1	7·9	7·8	"	3	P	
"	3297	"	"	" 9	17 49	52	40 W	− 4·5	− 5·4	1·4	1·5	"	4–5	P[1]	
"	3322	"	"	" 11	16 26	73	27 E	1·0	1·0	6·0	5·8	"	5	H	
"	3342	"	"	" 18	16 02	86	21 E	− 2·5	− 4·0	2·8	2·6	"	3–4	H	
"	3365	"	"	" 28	17 27	50	1 27 W	10·3	9·6	18·5	18·4	"	5	C	
"	3376	"	"	Apr. 6	16 50	100	1 30 W	10·0	8·1	16·6	16·5	"	3–0	P[1]	
"	3379	"	"	" 11	15 45	60	45 W	4·6	3·5	9·6	9·5	"	4	C	
"	3387	"	"	" 12	18 32	65	3 35 W	0·0	− 0·6	6·8	6·8	"	4	P[1]	
"	3396	"	"	" 14	17 10	90	2 40 W	9·6	8·2	12·1	12·0	"	3	P	
"	3398	"	"	" 20	17 46	120	3 50 W	10·7	9·0	15·9	16·0	"	2–0–2	P[1]	
"	3408	"	"	" 27	16 19	72	3 35 W	3·5	3·0	14·7	14·8	"	5	P[1]	
"	3420	"	"	May 4	17 12	65	3 45 W	9·4	8·6	13·6	13·6	"	4	C	
"	3423	"	"	" 5	14 10	60	50 W	11·5	9·7	14·4	14·4	"	3–4	P	
"	3438	"	"	" 10	17 22	60	4 15 W	10·0	9·6	15·8	15·7	"	4	C	

"	3442	"	"	" 11	16	27	66	3 28 W	7·0	7·0	16·3	15·5	"	3–4	H	
"	3447	"	"	" 12	15	06	59	2 05 W	7·0	6·0	18·0	17·8	"	...	P	
"	3450	"	"	" 16	16	20	120	4 07 W	14·1	14·0	21·6	21·4	"	2–3	C	
"	3452	"	"	" 19	13	50	60	1 20 W	14·3	13·3	18·4	18·4	"	4	P	
"	3459	"	"	" 27	17	07	65	5 15 W	......	12·0	......	16·1	"	4	P[1]	
"	3469	"	"	June 4	13	45	60	2 20 W	14·3	13·0	22·0	22·7	"	4	C	
"	3472	"	"	" 8	13	47	65	2 38 W	17·5	16·0	20·1	19·8	"	4	H	
"	3474	"	"	" 9	13	47	65	2 42 W	17·5	17·0	21·2	21·05	"	4–5	H	
"	3479	"	"	" 15	14	56	62	4 10 W	20·5	20·2	26·2	26·0	"	4	P[1]	
"	3494	"	"	" 24	13	48	24	....	22·0	......	25·5	......	"	4–0	H	Clouded.

MEASURES OF 93 LEONIS

(Comparator Measures, Standard Sun Plate 3755).

Region.	1341.		1356.		1381.		1388.		1398.		1498.		1498.*	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4	−28·73	...	−19·48	...	−28·11	...	....	...	+12·58	...	+50·55	...	+53·88	...
5	−25·54	...	−18·06	...	−24·71	...	....	...	....	...	+46·63	...	+36·83	...
6	....	...	....	...	....	...	....	...	....	...	+24·84	...	....	...
7	−29·00	...	−15·75	...	−20·09	...	−17·92	...	+ 6·52	...	+41·27	...	+30·41	...
8	−30·57	...	−22·66	...	−20·03	...	−16·13	...	+ 3·69	...	+37·94	...	....	...
9	−24·72	...	−20·68	...	−19·37	...	− 5·85	...	+ 6·56	...	+33·30	...	....	...
10	−31·43	...	−17·89	...	−19·34	...	−13·73	...	....	...	+36·75	...	....	...
11	−36·45	...	....	...	−18·09	...	−14·88	...	....	...	+41·45	...	....	...
12	....	...	....	...	−18·90	...	−15·30	...	....	...	+35·10	...	....	...
13	....	...	....	...	−27·95	...	....	...	....	...	....	...	....	...
Weighted Mean	−29·49		−19·09		−21·84		−14·45		+5·53		+38·62		+39·89	
V_a	+ 7·96		+ 6·07		+ 2·08		− ·37		−3·83		−17·81		−17·81	
V_d	− ·12		+ ·06		− ·16		− ·09		− ·16		+ ·10		+ ·10	
R. V. of Sun	− ·48		− ·48		− ·48		− ·48		− ·48		− ·48		− ·48	
Rad. Velocity	−22·1		−13·4		−20·4		−15·3		+1·0		+20·4		+21·7	

MEASURES OF 93 LEONIS—(Continued).

(Comparator Measures, Standard Sun Plate 3755).

Region.	1534.		1562.		1599.		1599.*		1627.		2100.		2134.		2231.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4	+10·11	..	+46·24		+51·79	..	+42·91	..	+36·84	..	− 9·86	..	+19·97	..	....	..
5	....	..	36·83	..	45·14	..	42·76	..	30·65	..	−10·69	..	9·74	..	−17·58	..
6	....	..	....	..	47·42	..	....	..	....	..	....	..	....	..	....	..
7	13·57	..	41·59	..	39·10	..	42·57	..	40·18	..	− 4·13	..	16·51	..	19·87	..
8	8·43	..	42·69	..	41·11	..	40·89	..	40·58	..	+ 2·32	..	+14·23	..	9·17	..
9	12·31	..	39·55	..	34·31	..	....	..	+36·83	..	− 3·03	..	....	..	22·00	..
10	7·25	..	+41·58	..	40·61	..	+34·04	..	....	..	....	..	....	..	−18·37	..
11	11·11	..	....	..	33·91	..	....	..	....	..	....	..	....	..	....	..
12	9·18	..	....	..	+36·90	..	....	..	....	..	....	..	....	..	....	..
13	+13·89	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..
Weighted Mean	+10·73		+41·41		+41·14		+40·63		+37·02		− 5·08		+14·63		−17·40	
V_a	−26·28		−27·80		−27·92		−27·92		−26·96		+25·48		+23·47		+15·89	
V_d	− ·09		− ·16		− ·20		− ·20		− ·25		− ·05		+ ·09		+ ·13	
R.V. of Sun	− ·48		− ·48		− ·48		− ·48		− ·48		− ·48		− ·48		− ·48	
Radial Velocity	−16·1		+13·0		+12·5		+12·0		+ 9·3		+19·9		+37·7		− 1·9	

* Check Measurement.

MEASURES OF 93 LEONIS—(Continued).
(Comparator Measures, Standard Sky Plate 3172).

Region.	2341.		2355.		2381.		2437.		2448.		2481.		2501.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4	+ 6·82	...	+19·45	...	......	...	......	...	......	...	......	...	+ 1·37	...
5	10·07	...	22·57	...	......	...	+42·64	...	+35·42	...	+18·11	...	+13·38	...
6	3·63	...	21·40	...	+30·84	...	34·24	...	39·66	...	32·73	...	− 9·44	...
7	14·20	...	22·99	...	25·65	...	35·94	...	38·11	...	18·15	...	+ 5·81	...
8	+11·74	...	16·88	...	23·63	...	43·65	...	36·67	...	31·08	...	+ 5·59	...
9	......	...	17·33	...	27·71	...	+53·10	...	+36·89	...	20·35	...	+ 6·71	...
10	......	...	9·69	...	+29·29	...	......	...	......	...	+20·46	...	+ 0·86	...
11	......	...	+10·40	...	......	...	......	...	......	...	......	...	......	...
Weighted Mean	+ 9·29		+17·59		+27·68		+40·67		+37·61		+23·48		+ 3·47	
V_a	+ ·24		− 1·72		− 3·09		− 9·81		−10·74		−14·19		−20·25	
V_d	− ·09		− ·04		− ·02		+ ·04		− ·06		− ·04		− ·23	
R. V. of Sun	+ ·26		+ ·26		+ ·26		+ ·26		+ ·26		+ ·26		+ ·26	
Radial Velocity	+ 9·7		+16·1		+24·8		+31·2		+27·1		+ 9·5		−16·8	

MEASURES OF 93 LEONIS—(Continued).

(Comparator Measures, Standard Sky Plate 3172).

Region.	2509.		2521.		2528.		2536.		2548.		2562.		2582.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4	+10·27	...	− 9·18	...	......	...	......	...	......	...	......	...	+28·77	...
5	6·56	...	− 9·84	...	+11·81	...	+ 0·26	...	+49·86	...	+45·92	...	26·50	...
6	2·77	...	− 8·81	...	+11·33	...	− 7·18	...	42·18	...	41·80	...	28·58	...
7	9·07	...	− 4·23	...	+ 6·65	...	− 4·23	...	43·32	...	46·22	...	27·59	...
8	+ 1·75	...	+ 0·93	...	−11·41	...	+ 8·38	...	38·18	...	51·80	...	+28·52	...
9	......	...	......	...	− 7·27	...	+ 2·80	...	44·16	...	50·09	...	......	...
10	......	...	......	...	− 4·52	...	......	...	+45·77	...	53·31	...	......	...
11	......	...	......	...	+ 4·16	...	......	...	......	...	+49·92	...	......	...
12	......	...	......	...	+ 0·80	...	......	...	......	...	......	...	......	...
Weighted Mean	+ 6·34		− 6·06		+ 1·70		+ 0·03		+44·17		+48·70		+27·99	
V_a	−19·90		−20·87		−21·51		−22·59		−27·09		−28·41		−26·97	
V_d	− ·14		− ·23		− ·14		− ·07		− ·13		− ·21		− ·27	
R.V. of Sun	+ ·26		+ ·26		+ ·26		+ ·26		+ ·26		+ ·26		+ ·26	
Radial Velocity	−13·7		−26·9		−19·7		−22·4		+17·2		+20·3		+ 1·0	

MEASURES OF 93 LEONIS—(Continued).
(Comparator Measures, Standard Sky Plate 3172).

Region.	2586.		2595.		2633.		2637.		2645.		2665.		2700.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4	+13·51	...	+11·81	...	......	...	−16·03	...	− 5·75	...	− 2·06	...	......	...
5	16·37	...	8·81	...	+ 4·59	...	19·02	...	− 3·67	...	12·86	...	+16·40	...
6	25·65	...	11·74	...	7·30	...	13·85	...	+ 0·63	...	6·04	...	31·21	...
7	18·86	...	10·71	...	1·81	...	5·81	...	− 1·45	...	3·87	...	30·85	...
8	14·35	...	12·30	...	3·26	...	4·42	...	− 7·22	...	10·13	...	35·00	...
9	16·91	...	10·23	...	5·59	...	12·30	...	− 5·59	...	8·94	...	+19·01	...
10	+16·83	...	13·00	...	4·85	...	5·17	...	− 7·75	...	−14·00	...	......	...
11	......	...	+10·81	...	2·39	...	6·97	...	− 9·05	...	......	...	......	...
12	......	...	......	...	+ 4·00	...	− 8·01	...	......	...	......	...	......	...
Weighted Mean	+17·76		+11·44		+ 4·22		− 9·92		− 4·98		− 8·27		+29·92	
V_a	−27·30		−26·44		−24·84		−24·35		−23·26		−21·35		−16·92	
V_d	− ·21		− ·23		− ·28		− ·27		− ·28		− ·28		− ·29	
R.V. of Sun	+ ·26		+ ·26		+ ·26		+ ·26		+ ·26		+ ·26		+ ·26	
Radial Velocity	− 9·5		−15·0		−20·6		−34·5		−28·3		−29·6		+13·0	

MEASURES OF 93 LEONIS—(Continued).
(Comparator Measures, Standard Sky Plate 3172).

Region.	2929.		3116.		3140.		3162.		3199.		3249.		3257.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4	+ 1·64	...	+18·08	...	−10·00	...	−40·83	...	......	...	......	...	......	...
5	3·28	...	15·09	...	14·04	...	40·41	...	......	...	−10·23	...	− 4·66	...
6	4·41	...	7·30	...	20·14	...	39·03	...	−30·85	...	7·55	...	− 0·97	...
7	3·39	...	6·05	...	22·02	...	42·11	...	42·11	...	11·49	...	+ 2·50	...
8	3·72	...	+ 8·38	...	17·23	...	35·85	...	36·67	...	14·55	...	+ 1·12	...
9	6·37	...	......	...	−13·64	...	40·02	...	42·26	...	11·74	...	− 3·23	...
10	1·40	...	......	...	......	...	34·68	...	42·22	...	13·78	...	− 4·16	...
11	4·16	...	......	...	......	...	−37·23	...	−41·81	...	16·12	...	− 2·50	...
12	+ 6·01	...	......	...	......	...	......	...	......	...	−16·52	...	......	...
Weighted Mean	+ 3·95		+10·45		−15·92		−38·51		−39·06		−12·75		− 1·69	
V_a	+21·75		+22·33		+19·49		+17·20		+ 9·18		+ 4·34		+ 3·36	
V_d	+ ·30		− ·14		− ·04		+ ·11		+ ·06		+ ·06		− ·03	
R.V. of Sun	+ ·26		+ ·26		+ ·26		+ ·26		+ ·26		+ ·26		+ ·26	
Radial Velocity	+26·3		+32·9		+ 3·8		−20·9		−29·6		− 8·1		+ 1·9	

MEASURES OF 93 LEONIS—(Continued).

(Comparator Measures, Standard Sky Plate 3172).

Region.	3271.		3297.		3322.		3342.		3365.		3379.		3387.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4	+ 1·37	...	...	...	...	...	...	...	...	...	+11·37	...	+ 1·10	...
5	+ 1·57	...	...	...	...	...	+20·99	...	...	...	10·50	...	− 6·30	...
6	− 0·63	...	+20·40	...	+ 4·41	...	34·24	...	+34·87	...	11·58	...	+ 6·55	...
7	− 2·42	...	16·34	...	15·12	...	32·06	...	35·69	...	9·32	...	− 0·24	...
8	± 0·00	...	13·39	...	12·80	...	35·15	...	24·21	...	13·73	...	+ 7·92	...
9	− 1·12	...	19·79	...	20·68	...	38·01	...	34·43	...	13·97	...	− 1·12	...
10	− 0·54	...	17·45	...	20·46	...	29·83	...	16·69	...	6·25	...	+ 1·61	...
11	+ 1·87	...	17·47	...	18·93	...	24·96	...	28·08	...	10·61	...	− 3·85	...
12	− 4·80	...	+16·72	...	+22·22	...	24·02	...	31·03	...	+ 5·00	...	...	...
13	...	...	...	...	...	...	24·56	...	...	...	...	...	...	...
14	...	...	...	...	...	...	+28·06	...	+30·19	...	...	...	...	...
Weighted Mean	− 0·52		+17·63		+16·63		+29·19		+29·40		+10·26		+ 0·97	
V_a	+ 2·89		− 0·12		− 1·08		− 4·51		− 9·27		−15·33		−15·78	
V_d	+ ·11		0·00		+ ·09		+ ·09		− ·09		− ·02		− ·21	
R.V. of Sun	+ ·26		+ ·26		+ ·26		+ ·26		+ ·26		+ ·26		+ ·26	
Radial Velocity	+ 2·7		+17·8		+15·9		+25·0		+20·3		− 4·8		−14·8	

MEASURES OF 93 LEONIS—(Continued).

(Comparator Measures, Standard Sky Plate 3172).

Region.	3396.		3398.		3408.		3420.		3423.		3438.		3442.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4	− 5·75	...	−12·33	...	...	...	+ 3·70	...	...	...	...	...	...	...
5	− 0·26	...	...	...	+ 1·71	...	2·36	...	+13·12	...	+21·91	...	+15·74	...
6	− 1·01	...	−11·58	...	+15·74	...	0·25	...	8·81	...	19·51	...	16·37	...
7	− 9·32	...	3·87	...	−10·04	...	0·24	...	10·89	...	18·15	...	21·17	...
8	+ 0·58	...	11·87	...	−12·80	...	5·24	...	15·13	...	16·30	...	25·03	...
9	− 4·14	...	7·27	...	− 3·58	...	1·12	...	+16·43	...	21·47	...	21·80	...
10	− 1·94	...	5·60	...	−10·45	...	0·86	...	...	...	22·40	...	23·15	...
11	− 4·99	...	6·45	...	− 2·68	...	8·01	...	...	...	19·97	...	+26·52	...
12	− 3·50	...	−11·71	...	−15·01	...	5·50	...	...	...	15·82	...	...	...
13	+ 0·48	...	...	...	− 2·89	...	6·93	...	...	...	+23·11	...	...	...
14	− 3·44	...	...	...	−10·22	...	+ 5·11	...	...	...	...	...	...	...
Weighted Mean	− 3·03		− 6·95		− 5·01		+ 3·83		+12·88		+20·11		+21·40	
V_a	−16·52		−18·79		−21·12		−23·17		−23·40		−24·65		−24·86	
V_d	− ·14		− ·21		− ·21		− ·21		− ·03		− ·20		− ·21	
R. V. of Sun	+ 0·26		+ 0·26		+ 0·26		+ 0·26		+ 0·26		+ 0·26		+ 0·26	
Radial Velocity	−19·4		−25·7		−26·1		−19·3		−10·3		− 4·5		− 3·4	

MEASURES OF 93 LEONIS—(Continued).
(Comparator Measures, Standard Sky Plate 3172).

Region.	3441.		3450.		3452.		3459.		3469.		3472.		3474.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4							+53·43	...	+38·36	...	+41·10	...		...
5	+31·49	...					51·82	...	43·30	...	45·66	...	+50·12	...
6	28·33	...	+36·76	..	+44·69	...	45·32	...	56·28	...	54·13	...	54·77	...
7	22·63	...	38·48	...	37·75	...	58·08	...	53·48	...	42·96	..	42·35	...
8	23·28	...	39·58	...	38·99	...	55·52	...	55·29	...	44·00	...	41·32	...
9	19·57	...	29·96	...	41·92	...	43·04	...	46·96	...	55·00	...	49·19	...
10	+24·77	...	+28·00	...	45·77	...	+49·22	...	46·31	...	48·46	...	42·54	...
11					43·16	...			48·36	...	45·97	...	35·67	...
12					44·54	...			+40·04	...	45·54	...	44·84	...
13					38·81	...					41·60	...	46·22	...
14					+42·92	...					+42·27	...	+49·70	...
Weighted Mean	+24·23		+34·82		+42·32		+50·92		+47·60		+46·32		+45·67	
V_a	−25·07		−25·87		−25·26		−27·20		−27·91		−27·99		−27·99	
V_d	− ·11		− ·21		− ·09		− ·30		− ·13		− ·14		− ·12	
R. V. of Sun	+ 0·26		+ 0·26		+ 0·26		+ 0·26		+ 0·26		+ 0·26		+ 0·26	
Radial Vel.	− 0·7		+ 9·0		+17·2		+23·7		+19·8		+18·4		+17·8	

MEASURES OF 93 LEONIS—(Continued).
(Micrometer Measures).

λ	1341.		1341.*		1356.		1381.		1388.		1398.		1498.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4549	−36·24	1	−31·27	2	−21·43	½	−22·03	2	−10·84	½	+10·47	1		
4481													+32·92	½
4415	−25·96	1	−34·00	1	−28·05	1	−38·94	1	−25·63	1	−20·35	2	+31·35	2
4404	−40·84	1	−52·86	1	−25·35	1	−15·62	2	−25·66	2	− 0·87	2	+29·16	2
4352					−11·57	1	− 7·26	2	− 7·78	1	−13·68	½		
4340	−37·50	1	−30·38	2	−25·26	1	− 5·22	1	−21·30	2	+15·35	1½	+33·72	1
4325	−35·33	½	−42·35	1	−21·03	1			−10·23	2	−14·56	2		
4315	−37·10	1												
4271	−17·16	1½	−16·76	2			−25·10	1	+ 8·04	1½			+24·10	2
4260	−31·00	1	−34·42	2							+ 3·25	2	+37·00	1
4227	−22·14	1½	−37·98	2	−14·86	1	−25·03	1	−16·11	2	− 2·78	1		
4202			−31·90	2	−21·64	1								
4143	−28·60	½	−33·85	1					−21·46	1				
4132	−22·69	1	−25·23	2										
4092	−25·72	1												
4102			−37·58	1					−14·15	1	−32·72	½		
4071	−23·02	1												
4063	−34·94	1												
4045	−31·79	½											+23·87	
Weighted Mean	−30·00		−32·45		−21·18		−18·42		−17·25		− 6·28		+28·98	
V_a	+ 7·96		+ 7·96		+ 6·07		+ 2·08		− ·37		− 3·83		−17·81	
V_d	− ·12		− ·12		+ ·06		− ·16		− ·09		− ·16		+ ·10	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Vel.	−22·4		−24·2		−15·3		−16·8		−18·0		−10·5		+15·6	

* Check measurement.

MEASURES OF 93 LEONIS—(Continued).
(Micrometer Measures).

λ	1534.		1562.		1599.		1627.		2022.		2062.		2100.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861													−18·46	½
4549	+ 0·60	2	+33·35	2	+37·68	½	+32·39	1	−59·28	¼	−40·26	½	− 5·68	½
4481					+40·63	½	+58·35	¼			−18·38	½	+ 0·69	½
4454							+26·35	½					+ 4·28	1
4415	+12·76	2	+58·19	1			+47·39	1						
4404	+ 9·39	3	+45·32	2										
4383									−57·67	¼	−18·72	¼		
4352	+11·89	2			+51·02	1							+15·88	½
4340	+18·16	2	+41·45	2	+48·44	1	+33·62	1½	−30·56	¼			+11·44	1
4325			+24·07	2			+59·23	1	−38·75	¼			+ 8·31	½
4271	+18·05	2			+37·30	½					−12·98	¼	− 8·59	½
4260	+ 2·07	1												
4227	+11·03	1	+35·58	2	+32·99	½	+38·17		−63·47	¼				
4167							+46·99	½						
4143	− 4·49	1	+31·70	1										
4123					+28·82	1								
4102			+23·87	1									− 5·42	½
4092	+ 7·58													
Weighted Mean	+ 9·71		+36·56		+40·52		+41·32		−49·91		−24·83		+ 1·63	
V_a	−26·28		−27·80		−27·92		−26·96		+28·84		+27·40		+25·48	
V_d	− .09		− ·16		− ·20		− ·25		+ ·02		− ·03		− ·05	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Vel.	−16·9		+ 8·3		+12·1		+13·8		−21·3		+ 2·3		+26·8	

MEASURES OF 93 LEONIS—(Continued).
(Micrometer Measures).

λ	2134.		2231.		2262.		2300.		2341.		2355.		2381.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861	− 5·53	½	−19·81	½			−26·32	½						
4549			−40·86	¼	−52·35	½	−52·71	¼	+ 6·53	1			+ 9·20	½
4481	+ 3·01	¼					−37·11	¼	− 7·27	¼	+13·26	½	+38·14	½
4443							−46·13	½						
4415			−16·92	½	−49·01	¼								
4404			−24·92	¼	−27·23	¼								
4395			−14·29	¼										
4352									+ 6·88	½	+ 5·84	½	+30·80	½
4340	− 7·24	½	−16·80	1	−24·46	½	−25·93	½	+ 0·23	½	+33·50	½	+16·67	½
4325			−43·09	¼										
4315	− 7·65	½							− 6·70	½				
4308									− 3·05	½				
4271	−13·69	½	−33·33	½	−22·78	¼	−22·78	¼	− 0·77	1	+19·16	½		
4227			−16·52	½	−10·69	¼			− 3·62	½				
4143			−28·05	½										
4102	−27·82	¼	−33·25	1			−45·24	½			+ 3·08	1		
Weighted Mean	− 3·50		−25·12		−32·92		−35·98		− 0·17		+12·99		+23·70	
V_a	+23·47		+15·89		+13·63		+ 7·11		+ 0·24		− 1·72		− 3·09	
V_d	+ ·09		+ ·13		− ·11		− ·09		− ·09		− ·04		− ·02	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Vel.	+19·8		− 9·4		−19·7		−29·4		− 0·3		+11·3		+20·3	

MEASURES OF 93 LEONIS—(Continued).

(Micrometer Measures).

λ	2437.		2448.		2469.		2481.		2501.		2509.		2521.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4549	......	...	+21·31	½	......	...	......	...	− 2·80	½	+15·32	¼	+17·98	½
4481	+29·30	½	+18·98	¼	+20·00	¼	+15·80	1	+18·73	½	......	...	......	...
4352	+28·54	½	+18·18	½	+52·19	½	+26·80	½	+13·23	½	+ 2·21	½	+16·66	¼
4340	+45·66	½	+51·43	½	+33·29	½	+19·07	1	+14·45	1	......	...	− 7·51	¼
4325	......	...	......	...	......	...	+16·58	½	− 5·15	½	......	...	......	...
4315	......	...	......	...	......	...	......	...	......	...	− 3·97	½	......	...
4271	+23·85	½	+34·07	¼	......	...	+16·27	½	+11·10	1	......	...	......	...
4227	+39·29	½	......	...	+48·87	½	+28·79	½	+ 5·42	½	......	...	+14·66	½
4102	......	...	......	...	......	...	+10·48	1	−10·39	½	......	...	......	...
4063	......	...	......	...	......	...	+25·44	½	......	...	......	...	......	...
4045	......	...	......	...	......	...	+28·17	½	......	...	......	...	......	...
Weighted Mean	+33·33		+38·13		+41·24		+19·66		+ 7·01		+ 2·35		+12·40	
V_a	− 9·81		−10·74		−10·27		−14·19		−20·25		−19·90		−20·87	
V_d	+ ·04		− ·06		− ·28		− ·04		− ·23		− ·14		− ·23	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+23·3		+22·7		+30·4		+ 5·1		−13·8		−18·0		− 9·0	

MEASURES OF 93 LEONIS—(Continued).

(Micrometer Measures).

λ	2528.		2536.		2548.		2562.		2582.		2586.		2595.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4549	− 7·19	¼	+21·85	¼	......	...	......	...	+12·64	½	......	...	+27·14	½
4481	− 7·52	¼	+30·32	½	+15·39	½	......	...	......	...	+31·93	½	......	...
4395	......	...	......	...	......	...	......	...	+29·87	½	......	...	......	...
4383	......	...	+32·06	½	......	...	......	...	+39·51	½	......	...	......	...
4352	+10·95	½	......	...	+43·15	½	+62·14	1	+32·71	1	+44·90	1	+10·82	½
4340	+ 8·67	½	+ 4·28	¼	+39·12	½	+51·24	1	+11·08	1	+11·08	½	+16·85	1
4325	......	...	......	...	......	...	......	...	+42·60	½	+31·40	1	......	...
4300	......	...	......	...	+26·56	¼	......	...	......	...	......	...	......	...
4271	+ 9·34	¼	+ 5·82	½	......	...	......	...	......	...	+13·39	½	+27·48	½
4233	......	...	......	...	......	...	......	...	......	...	......	...	+31·47	¼
4227	−12·32	½	− 0·11	¼	+29·91	½	+44·02	½	......	...	+17·28	½	+23·97	½
4216	−19·50	¼	......	...	......	...	......	...	......	...	......	...	......	...
4102	......	...	......	...	......	...	+21·99	¼	......	...	......	...	+16·33	½
4045	......	...	......	...	......	...	......	...	......	...	......	...	+27·67	½
Weighted Mean	− 1·01		+14·04		+31·30		+51·24		+23·80		+28·28		+21·51	
V_a	−21·51		−22·59		−27·09		−28·41		−26·97		−27·28		−26·44	
V_d	− ·14		− ·07		− ·13		− ·21		− ·27		− ·21		− ·23	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−23·0		− 8·9		+ 3·8		+22·3		− 3·7		+ 0·4		− 5·5	

MEASURES OF 93 LEONIS—(Continued).
(Micrometer Measures).

λ	2604.		2633.		2637.		2645.		2665.		2700.		2929.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861			+33·82	¼	−10·74	½	+13·94	½	+ 9·94	½	+30·80	¼		
4549	+30·60	½			− 6·79	½	+28·07	½	+15·97	½	+14·23	1		
4481			− 8·78	1			+ 9·03	¼	− 0·25	½	+ 9·67	½	− 2·68	½
4352	+12·57	½	+18·38	1	−15·71	½	+10·24	1	+26·41	¼	+26·31	½	− 1·87	¼
4340	+ 8·54	¼	+11·43	½	− 1·27	1	+13·62	½	+ 4·15	½	− 5·65	½	+ 8·80	1
4325					+20·67	½			+29·08	½				
4271	+24·14	¼	− 5·93	¼							+37·08	½	+ 7·27	1
4260													+19·60	½
4227			+ 3·61	1	+12·09	½							+10·00	1
4216			−20·52	½										
4143									− 2·29	¼				
4102													+ 6·94	½
4063													+19·32	½
4045													+ 5·79	¼
Weighted Mean	+19·84		+ 3·48		+ 0·43		+14·66		+11·01		+17·12		+ 8·94	
V_a	−26·12		−24·84		−24·35		−23·26		−21·35		−16·92		+ 21·75	
V_d	− ·28		− ·28		− ·27		− ·28		− ·28		− ·29		+ ·20	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 6·9		−22·0		−24·0		− 9·2		−10·9		− 0·4		+ 30·6	

MEASURES OF 93 LEONIS—(Continued).
(Micrometer Measures).

λ	3116.		3145.		3162.		3190.		3211.		3249.		3257.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861			−39·83	½	−43·36	½					− 8·67	¼		
4549					− 3·47	½			−16·95	½	−16·27	½	+ 4·13	¼
4481					−49·11	¼							− 3·18	½
4352	+21·71	½											+ 7·22	½
4340	− 4·40	½	−28·69	1	−28·93	1	−21·52	1	−50·10	½	−19·21	½	− 0·92	1
4325			−27·48	½	−34·35	½					−32·98	¼	− 7·78	½
4308			−11·98	½									+ 4·06	½
4271	+ 0·11	½	−25·21	½										
4216			−44·20	¼					−47·37	½				
4102	+ 8·19	½			−58·65	¼			−31·12	1	−17·24	1	+ 2·12	½
4071	+ 0·09	1												
4063									−35·93	½	± 0·00	¼	− 1·12	¼
4045			−13·51	½							−16·91	½		
Weighted Mean	+ 4·29		−26·33		−32·15		−21·52		−35·43		−16·56		+ 0·26	
V_a	+22·33		+19·49		+17·20		+ 9·18		+ 6·81		+ 4·34		+ 3·36	
V_d	− ·14		− ·04		+ ·11		+ ·06		+ ·14		+ ·06		− ·03	
Curv.	− ·28		− ·30		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+26·3		− 7·2		−15·1		−12·6		−27·8		−12·4		+ 3·3	

MEASURES OF 93 LEONIS—(Continued).
(Micrometer Measures).

λ	3271.		3297.		3222.		3342.		3365.		3376.		3379.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861			+ 8·02	¼	+ 9·31	½	+ 7·23	¼	+51·78	¼			+19·09	½
4549	+ 4·80	¼	+26·11	½			+ 9·60	½	+23·81	¼	+25·14	½	+10·26	½
4481	− 8·54	½	−12·23	¼	− 3·95	¼			+31·04	½	+13·10	¼	+ 6·62	½
4404			+ 5·08	½	+13·90	¼								
4352	− 0·58	½	+ 8·16	¼	+22·25	½	+25·44	½	+25·03	½	+10·94	¼	+14·10	½
4340	+ 6·13	1	+24·85	1	+23·70	1	+23·95	1	+22·85	1	+12·00	½	+ 0·23	1
4325	+ 1·14	½			+12·24	½	+23·70	¼	+18·04	¼			+ 6·06	¼
4271													+17·36	½
4250			+22·05	¼										
4227			+21·88	½									+16·99	½
4102	−10·97	½	+ 5·96	1	− 0·19	½	+12·04	1	+21·22	½				
4071			+22·42	¼	+25·42	½							+26·93	¼
4063	− 8·39	¼					+18·20	½						
4045	− 3·21	½							+17·31	½			+ 1·74	¼
Weighted Mean	− 1·46		+15·43		+16·29		+17·59		+24·95		+16·39		+10·24	
V_a	+ 2·89		− 0·12		− 1·08		− 4·51		− 9·27		−13·27		−15·33	
V_d	+ ·11		·00		+ ·09		+ ·09		− ·09		− ·07		− ·02	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 1·3		+15·0		+15·0		+12·9		+15·3		+ 2·8		− 5·4	

MEASURES OF 93 LEONIS—(Continued).
(Micrometer Measures).

λ	3387.		3396.		3398.		3408.		3420.		3423.		3438.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861	+16·36	½					− 5·46	½					+ 4·65	½
4549			+17·85	½					− 4·13	½	+ 4·93	¼	+16·52	½
4481	−10·27	¼	+ 8·79	½					− 3·82	¼	− 1·27	½		
4415	+ 3·26	½	+25·58	½										
4404					+ 1·09	½	− 3·02	½	− 3·63	¼	− 2·18	½	+22·50	¼
4352	+10·36	½	+ 5·36	1	+ 4·19	¼	−15·26	½			+ 0·93	½	+ 3·61	¼
4340	+ 2·66	1	+11·56	1	− 7·62	1	− 8·44	½	+ 9·02	1	+ 5·43	½	+ 4·05	½
4325	+10·18	½	− 5·95	½	− 9·02	¼	− 8·01	½	+ 6·06	½	+ 0·57	½	+ 4·92	½
4271	+18·24	½	+ 0·77	1			+ 2·42	½	+ 9·67	½				
4227	+ 7·22	½	+ 6·69	½	−13·16	½	− 4·89	½			+ 2·87	½	+ 9·98	½
4198			+12·57	½			− 9·95	½						
4102									− 2·12	½	−11·74	¼	− 2·69	¼
4063	+21·71	¼									− 4·85	½	+ 8·11	½
4045	− 3·68	¼			+12·00	½			+13·95	½			+ 4·04	½
Weighted Mean	+ 7·88		+ 8·40		− 2·11		− 6·09		+ 4·72		− 0·25		+ 7·36	
V_a	−15·78		−16·52		−18·79		−21·12		−23·17		−23·40		−24·65	
V_d	− ·21		− ·14		− ·21		− ·21		− ·21		− ·03		− ·20	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 8·4		− 8·5		−21·4		−27·7		−18·9		−24·0		−17·8	

MEASURES OF 93 LEONIS—(Continued).

(Micrometer Measures).

λ	3442.		3447.		3450.		3452.		3459.		3469.		3472.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861							+30·94	½			+44·56	½		
4549			+24·34	½	+18·75	¼			+54·66	½	+42·69	1	+29·39	½
4520													+68·67	¼
4481	+27·86	¼	+26·84	¼	+11·70	¼			+36·38	¼			+45·66	½
4415					+10·82	½					+51·92	¾	+62·38	½
4404	+ 4·95	½	+16·31	½	+28·75	½	+16·67	½	+61·73	½	+44·21	¾		
4352	+29·49	½	+ 6·63	¼	+44·35	½			+55·29	½	+48·66	¼		
4340	+18·35	1	+16·04	½	+39·12	½	+42·01	1	+62·43	½	+50·54	½	+53·31	1
4325	+ 8·11	½					+23·87	½						
4315							+24·25	½	+78·91	½				
4271	+31·94	½	+20·29	½			+39·60	½					+49·14	½
4260											+42·72	1	+57·24	½
4227			+22·71	½	+29·39	½							+46·05	½
4143													+43·73	½
4102	+39·46	¼					+34·37	½	+61·44	½	+41·28	1	+44·74	½
4071							+39·77	½			+52·00	1		
4063	+37·68	½							+48·73	¼				
4045							+20·70	½						
Weighted Mean	+22·31		+19·41		+27·91		+31·42		+56·35		+46·00		+49·46	
V_a	−24·86		−25·07		−25·87		−25·26		−27·20		−27·91		−27·99	
V_d	− ·21		− ·11		− ·21		− ·09		− ·30		− ·13		− ·14	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 3·0		− 6·0		+ 1·6		+ 5·8		+28·5		+17·7		+21·0	

MEASURES OF 93 LEONIS—(Concluded).

(Micrometer Measures).

λ	3474.		3479.		3494.									
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861	+48·73	½												
4549	+59·05	½	+10·64	¼										
4481	+52·15	¼	+41·98	¼										
4415			+51·10	½	+ 0·37	½								
4404	+43·00	½			+ 5·56	¼								
4352	+34·45	½	+10·48	¼	+28·28	½								
4340	+51·24	½	+35·20	½										
4271	+59·35	1			− 7·90	½								
4227	+45·84	½												
4102	+49·54	½												
Weighted Mean	+50·17		+33·67		+ 6·72									
V_a	−27·99		−27·81		−27·02									
V_d	− ·12		− ·27		− ·27									
Curv.	− ·28		− ·28		− ·28									
Radial Velocity	+21·8		+ 5·3		−20·8									

SUMMARY OF OBSERVATIONS

Plate No.	Julian Date.	Phase.	Velocity.	Weight	Residual M.	Residual C.
1341	2,417,993·84	36·29	−23·6	6	− 4·1	+ 1·5
1356	996·73	39·18	−15·3	4	+ 4·6	+12·3
1381	8,005·82	48·27	−16·8	4	+ 3·0	+ 0·8
1388	010·77	53·22	−15·2	3	− 0·7	+ 2·0
1398	017·79	61·04	−10·5	3	−11·0	− 2·0
1498	049·57	20·32	+ 8·1	5	+ 3·1	+13·0
1534	080·57	51·32	−16·9	6	± 0·0	± 0·0
1562	094·59	66·14	+ 8·3	4	− 4·0	− 0·7
1599	105·62	4·67	+12·1	3	−14·0	−14·0
1627	117·60	16·65	+14·0	5	+ 2·0	− 4·7
2022	285·98	41·63	−21·3	3	− 1·5	....
2062	297·89	53·54	+ 2·3	2	+15·3	....
2100	313·94	70·39	+26·8	6	+ 6·4	− 1·5
2134	320·83	4·78	+19·8	3	− 4·0	+11·6
2231	341·67	25·62	− 9·4	5	− 4·0	+ 1·2
2262	346·88	30·83	−19·7	2	− 6·3	....
2300	360·82	44·77	−29·0	3	− 8·0	....
2341	374·78	59·53	− 0·3	3	+ 2·0	+ 8·0
2355	378·74	63·49	+11·3	4	+ 6·0	+ 6·1
2381	381·72	66·47	+20·3	3	+ 6·5	+ 8·5
2437	395·66	7·91	+23·3	3	− 0·8	+ 5·0
2448	397·70	9·95	+22·7	3	+ 0·7	− 2·3
2469	398·85	11·10	+30·4	1	+ 9·8	....
2481	405·67	17·92	+ 5·1	5	− 4·1	− 2·2
2501	416·76	29·01	−13·8	4	+ 1·6	− 3·8
2509	420·69	32·94	−18·0	2	− 3·0	+ 6·1
2521	423·74	35·99	− 9·0	3	+10·0	+ 3·8
2528	425·68	37·93	−23·0	4	− 0·8	+ 5·1
2536	430·61	42·86	− 8·9	2	+ 6·1	+ 3·6
2548	451·60	64·65	+ 3·8	4	− 5·2	+ 4·4
2562	467·60	8·15	+22·3	4	− 1·5	− 5·9
2582	482·60	23·15	− 3·7	2	− 3·0	+ 0·5
2586	483·58	24·13	+ 0·4	2	+ 2·5	− 7·9
2595	486·58	27·13	− 5·5	5	+ 2·0	− 6·5
2604	488·60	29·15	− 6·9	2	+ 4·5	....
2633	496·58	37·13	−22·0	3	+ 0·1	+ 3·8
2637	497·57	38·12	−24·0	3	− 1·8	− 9·3
2645	501·57	42·12	− 9·2	3	+13·0	− 2·1
2665	508·57	49·12	−10·9	2	+ 8·5	− 9·6
2700	521·57	62·92	− 0·3	2	− 5·0	+ 3·7
2929	610·05	7·09	+30·6	4	+ 5·5	− 0·5
3116	686·97	12·42	+26·3	3	+ 7·5	+11·0
3145	697·87	23·32	− 7·2	4	− 6·0	+ 3·5
3162	703·77	29·23	−15·2	4	− 4·4	− 8·0
3199	721·76	46·21	−12·6	2	+ 8·5	− 6·3
3211	726·68	52·13	−27·8	2	−12·3	....
3249	731·73	57·98	−12·4	4	− 5·5	− 5·3
3257	733·74	59·99	+ 3·3	5	+ 4·8	− 0·6
3271	734·68	60·93	+ 1·3	4	− 1·2	− 1·8
3297	740·74	66·99	+15·0	4	+ 0·5	+ 0·5
3322	742·68	68·93	+15·0	3	− 2·8	− 4·8
3342	749·67	3·42	+12·9	3	−12·1	− 0·5
3365	759·73	13·48	+15·3	6	− 1·8	+ 0·3
3376	768·70	22·45	+ 2·8	2	+ 2·5	....
3379	773·66	27·41	− 5·4	4	+ 2·5	+ 4·5
3387	774·77	28·52	− 8·4	3	+ 1·5	− 3·5
3396	776·72	30·47	− 9·4	4	+ 3·5	− 3·9
3398	782·74	36·49	−21·4	3	+ 1·1	− 1·7

SUMMARY OF OBSERVATIONS—(Concluded).

Plate No.	Julian Date.	Phase.	Velocity.	Weight	Residual M.	Residual C.
3408	2,418,789·68	43·43	−27·7	5	− 5·5	− 0·5
3420	796·72	50·47	−18·9	5	− 0·8	− 1·5
3423	797·59	51·34	−24·0	4	− 7·0	+ 5·9
3438	802·72	57·27	−17·8	5	−10·8	− 0·2
3442	803·69	58·24	− 3·0	5	+ 2·0	− 1·4
3447	804·62	59·17	− 6·0	4	− 2·5	− 1·2
3450	808·68	63·23	+ 1·6	2	− 4·0	− 0·8
3452	811·58	66·13	+ 5·8	4	− 6·7	+ 2·5
3459	819·71	1·76	+28·5	4	+ 5·0	− 1·9
3469	827·57	9·62	+17·7	4	− 4·6	− 5·2
3472	831·57	13·62	+21·0	5	+ 3·5	− 1·5
3474	832·57	14·62	+21·8	5	+ 6·3	− 0·2
3479	838·62	20·67	+ 5·3	2	+ 0·7	....
3494	847·58	29·63	−20·8	2	− 8·1	....

Notes 1. Phases are from J. D. 2,418,029.255.
2. Weights are reckoned on standard 10, 5 for character of plate and 5 for agreement in measurement of lines.
3. Residual M is that from Micrometer measurement.
" C " " " Comparator "

The seventy-two observations were grouped into the following normal places:—

NORMAL PLACES

	Julian Date.	Phase.	Velocity.	Residual, O-C.	Weight.
1	2,418,317·48	37·28	−20·2	−0·12	3
2	515·92	43·02	−20·9	+1·25	2
3	497·50	48·93	−16·1	+3·18	1·5
4	338·54	52·02	−17·3	−1·55	2
5	672·90	57·74	−10·0	−4·12	2
6	649·39	60·11	+ 1·5	+2·26	2
7	480·61	64·81	+10·1	+0·23	2·5
8	456·85	69·10	+22·9	+4·46	1
9	543·96	4·35	+22·0	−3·13	2
10	556·70	9·61	+22·6	−0·01	2
11	804·94	13·88	+19·1	+2·36	2
12	267·14	18·58	+ 8·6	+0·46	2
13	626·12	23·27	− 3·0	−2·05	1
14	554·60	27·22	− 7·1	+0·94	2
15	601·07	30·09	−15·0	−2·55	2

Dr. King's graphic method was then used in determining the preliminary elements.

These were:—

$$\gamma = -\ 0.578 \text{ km.}$$
$$K = 24 \text{ km.}$$
$$e = .1$$
$$\omega = 330°$$
$$T = 2{,}418{,}028.85$$
$$P = 71.7 \text{ days.}$$
$$\text{and } \Sigma pvv = 147.1$$

It was decided to apply the method of least-squares to reduce this value of Σpvv if possible. Observation equations were formed by means of the formula of Lehmann-Filhés.*

OBSERVATION EQUATIONS

x	y	z	u	v	C-O-N	Weight.
1·000	− ·838	+ ·962	− ·332	+ ·310	−0·48	3
"	− ·913	+ ·838	+ ·078	− ·023	−1·59	2
"	− ·800	+ ·096	+ ·513	− ·415	−3·67	1·5
"	− ·656	− ·402	+ ·720	− ·630	+0·98	2
"	− ·242	−1·026	+ ·995	− ·980	+3·62	2
"	− ·024	−1·010	+1·044	−1·075	−2·66	2
"	+ ·437	− ·383	+ ·987	−1·087	−0·18	2·5
"	+ ·811	+ ·523	+ ·739	− ·830	−4·01	1
"	+1·086	+ ·883	+ ·066	− ·019	+3·50	2
"	+ ·954	− ·023	− ·447	+ ·548	−0·27	2
"	+ ·689	− ·744	− ·748	+ ·818	−3·14	2
"	+ ·320	− ·990	− ·922	+ ·918	−1·50	2
"	− ·057	− ·656	− ·940	+ ·871	+1·05	1
"	− ·345	− ·121	− ·852	+ ·759	−1·76	2
"	− ·526	+ ·289	− ·741	+ ·651	+1·81	2

in which

$$
\begin{aligned}
x &= \delta\gamma \\
y &= \delta K \\
z &= K\delta e = 24\ \delta e \\
u &= K\delta\omega = 24\ \delta\omega \\
v &= \frac{K\mu}{(1-e^2)^{\frac{3}{2}}}\ \delta T = 2.135\ \delta T
\end{aligned}
$$

From the above observation equations there result the following normal equations:—

$$
\begin{array}{llllll}
29{\cdot}000x & -\ 1{\cdot}182y & -\ 2{\cdot}673z & +\ {\cdot}426u & -\ {\cdot}436v & -\ 12{\cdot}375=0 \\
 & 12{\cdot}975y & -\ 2{\cdot}954z & -\ {\cdot}632u & +\ {\cdot}715v & +\ 3{\cdot}205=0 \\
 & & 14{\cdot}556z & -\ 2{\cdot}571u & +\ 2{\cdot}620v & +\ 5{\cdot}272=0 \\
 & & & 15{\cdot}578u & -15{\cdot}517v & +\ 4{\cdot}554=0 \\
 & & & & 15{\cdot}601v & -\ 4{\cdot}601=0
\end{array}
$$

The solution of which gives

$$
\begin{aligned}
x &= +\ .3791 \\
y &= -\ .3354 \\
z &= -\ .4327 \\
u &= +\ .4741 \\
v &= +\ .8652
\end{aligned}
$$

Hence the corrections

$$
\begin{aligned}
\delta\gamma &= +\ \ .379 \text{ km.} \\
\delta K &= -\ \ .335 \text{ km.} \\
\delta e &= -\ \ .018 \\
\delta\omega &= +\ 1''.146 \\
\delta T &= +\ \ .405
\end{aligned}
$$

* A.N. No. 3242.

These results gave satisfactory differences between the residuals from observation equations and the computed residuals, the highest difference being .06. Σpvv was reduced to 137.4.

The probable error of a normal place was found to be $\pm$ 2.5 and that of an average plate—found by scaling residuals from the curve — to be $\pm$ 3.4. Probable errors of the elements were also found and are given below together with the final values accepted.

$$\begin{aligned} \gamma &= -.20 \text{ km.} \pm .31 \\ K &= 23.665 \text{ km.} \pm .48 \\ e &= .082 \pm .02 \\ \omega &= 331°.15 \pm 0°.72 \\ T &= 2{,}418{,}029.255\ J.D. \pm 2.1 \text{ days} \\ P &= 71.7 \text{ days.} \\ a \sin i &= 23{,}250{,}000 \text{ km.} \end{aligned}$$

Thinking the probable error of a plate rather high for this type of star, it was decided to try measuring the plates with the spectro-comparator. All the plates, with the exception of ten which were too faint for this method, were re-measured. The standard plates used were Nos. 3172 and 3755, the former a sky plate taken with the new single-prism spectrograph and the latter a sun plate taken with the old.

The measures were grouped into fifteen normal places as before, each plate being placed in the same normal place as in the former work. These places are given below with the mean Julian Day, the phase from final T, the mean velocity, weight and residual from final curve.

NORMAL PLACES

	Julian Day.	Phase.	Velocity.	Weight.	Residual O-C.
1	2,418,317·48	49·83	−22·7	5	+2·09
2	631·43	55·47	−26·2	2	−0·11
3	497·50	61·48	−22·9	3	−2·38
4	285·08	64·31	−14·0	3	+1·75
5	672·90	70·79	− 3·5	4	−2·32
6	649·52	1·76	+ 5·8	3	+1·11
7	480·61	6·32	+17·2	5	+2·57
8	456·85	10·22	+18·5	2	−2·82
9	543·96	16·96	+25·0	3	−1·66
10	558·42	21·89	+24·7	3	−0·15
11	804·94	26·43	+18·9	3	−0·30
12	190·95	30·85	+13·7	3	+2·77
13	590·48	36·03	− 0·4	2	+0·22
14	562·36	39·55	− 8·8	3	−0·28
15	652·17	42·60	−18·4	3	−3·65

These normal places were plotted and the following preliminary elements were obtained graphically:—

$$\begin{aligned} \gamma &= 0 \\ K &= 26 \text{ km.} \\ e &= 0 \\ \omega &= 270° \\ T &= 2{,}418{,}088.405\ J.D. \\ P &= 71.70 \text{ days.} \end{aligned}$$

The value of Σpvv was computed and found to be 207. One least-squares solution was applied to the above elements. As seen above the eccentricity is zero. T and ω have been given values for the purposes of the solution. The value of T was taken as fixed, for with e zero and ω 270° it would be impossible to obtain corrections to e, ω and T as two of the equations would be identical. Observation equations were formed and normal equations found from them, as follows:—

$$
\begin{array}{lllll}
47x & + \cdot 183y & + 1\cdot 657z & + 2\cdot 498u & - 9\cdot 340 = 0 \\
 & 21\cdot 018y & - \cdot 967z & + \cdot 800u & - 11\cdot 476 = 0 \\
 & & 23\cdot 699z & + \cdot 887u & - 5\cdot 108 = 0 \\
 & & & 25\cdot 985u & - 10\cdot 570 = 0
\end{array}
$$

The solution of these equations gave the following corrections to the elements:—

$$
\begin{aligned}
\delta\gamma &= + \quad .17 \text{ km.} \\
\delta K &= + \quad .54 \text{ km.} \\
\delta e &= + \quad .008 \\
\delta\omega &= + \; 0^\circ.81
\end{aligned}
$$

Hence the corrected values of the elements:—

$$
\begin{aligned}
\gamma &= + \; .17 \text{ km.} \\
K &= 26.54 \text{ km.} \\
e &= .008 \\
\omega &= 270^\circ.81 \\
T &= 2{,}418{,}088.405 \; J.D. \\
P &= 71.70 \text{ days.} \\
a \sin i &= 26{,}170{,}000 \text{ km.}
\end{aligned}
$$

These elements gave a new value of Σpvv of 196. This is a very small reduction — about 5%, — but the excellent agreement between the residuals, computed and observation equations, showed that further application of least-squares would be useless.

The probable error of a normal place and of an average plate were computed and found to be ± 2.85 and ± 3.4 respectively. There were three plates 1498, 1599 and 2134 which for some unknown reason gave abnormally high residuals, being − 14.0, + 11.6 and + 13.0 respectively. If these be omitted the probable error of an average plate becomes ± 2.87.

The probable errors of the elements were also computed and are attached to the final values in the table below. The table gives the elements obtained in the two ways of measurement with their probable errors.

Element.	Micrometer.	Comparator.
γ	− ·20 km ± ·31	+ ·17 km ± ·42
K	23·665 km ± ·48	26·54 km ± ·62
e	·082 ± ·02	·008 ± ·02
ω	331°·15 ± ·0°·72	270°·81 ±1°·26
T	2,418,029·255 J.D. ± 2·1 d.	2,418,088·405 J.D.
P	71·70 days.	71·70 days.
$a \sin i$	23,250,000 km.	26,170,000 km.
Probable error of average plate	±3·5	±3·4 ±2·9*
Probable error of average normal place	±1·5	±1·4

* Omitting plates 1498, 1599 and 2134.

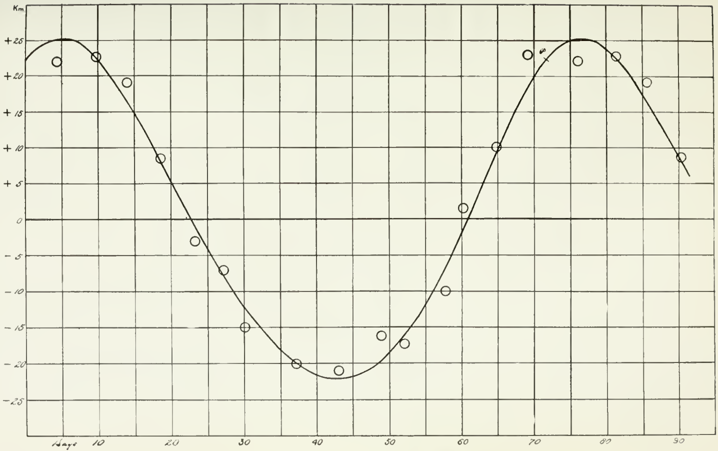


Fig. 7.—Velocity Curve of 93 Leonis.

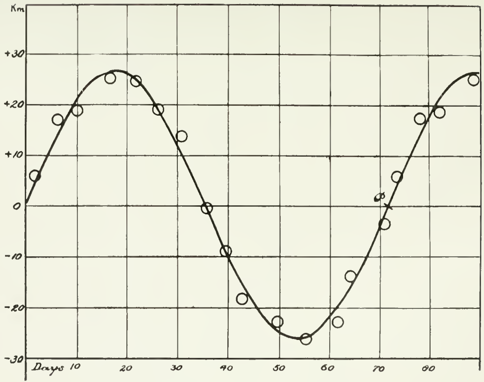


FIG. 8—Velocity Curve of 93 Leonis (Comparator Measurement).

Judging from the probable error of an average plate, there is little difference between the two methods of measurement. There is something to be said in favour of each. Underexposed plates may be measured by the micrometer, which would not permit of measurement by the comparator. On the other hand it is impossible to obtain good agreement in the velocities obtained from the various lines in a spectrum like that of this star, and on such a spectrum perhaps the best work can be done with the comparator, which enables the measurer to strike a mean all along the plate.

As regards the elements obtained, K is the only one which shows a change worthy of note. The eccentricity is very small in both cases and the differences in ω need not be remarked upon.

ι Cygni.

Seven plates of this star were taken and measured. The spectrum shows the hydrogen lines, β, γ, δ and ϵ, and the calcium line K. The magnesium line λ 4481 appears occasionally but is barely discernible. The lines are all very broad and difficult to measure accurately, as is shown by the widely different velocities obtained from the various lines on the same plate. The star was dropped from the observing list here on account of the programme being so full at that time. The measures follow:—

P—Plaskett.
H—Harper.
P¹—Parker.
C—Cannon.

RECORD OF SPECTROGRAMS

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure G.M.T.	Duration.	Hour Angle at End.	Temperature. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1907	h m	m	h m								
ι Cygni......	932	I L	Seed 27	July 9	17 52	45	0 53 E	20·2	19·7	25·0	24·9	·0014	Good.......	H	
"	1718	"	"	" 15	20 22	55	3 55 W	14·5	13·5	21·9	21·9	·0015	Fair........	H	
"	1804	"	"	Aug. 20	18 19	15	5 30 W	15·3	14·2	22·2	22·1	"	Fair........	P¹	
"	1824	"	"	" 24	18 22	55	4 35 W	14·2	13·5	22·6	22·7	"	Good.......	P¹	
"	1839	"	"	" 27	16 52	55	3 12 W	16·3	15·0	22·8	22·8	"	"	C	
"	1845	"	"	" 28	15 05	55	1 28 W	17·0	16·1	23·2	23·2	"	"	C	
"	1886	"	"	Sept. 14	14 34	52	2 05 W	16·9	15·5	21·6	21·5	"	Fair........	P	

MEASURES OF ι CYGNI.

λ	932.		1718.		1804.		1804.		1824.		1824.		1839	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861·527......	....	...	....	...	....	...	−12·18	1	− 3·62	½	+ 1·16	½	−33·23	½
4481·400......	− 6·79	½	....	...	....	...	....	...	....	...	....	...	....	...
4340·634......	−44·37	1½	− 2·40	1½	− 9·60	1	+ 1·35	½	$-24{\cdot}0_{1}$	1	−14·51	1	− 8·87	1
4101·890......	− 9·29	1	−19·70	1	−34·46	½	−44·26	½	$-31{\cdot}2^{1}_{4}$	1	−52·16	½	+ 7·55	¼
3933·825......	....	...	....	...	....	...	....	...	$+4{\cdot}9^{4}$	½	+ 5·84	½	− 4·27	½
Weighted Mean......	−26·41		− 9·32		−17·89		−16·82		−18·20		−14·84		−11·45	
V_a	+ 6·44		+ 5·07		− 2·56		− 2·56		− 3·41		− 3·41		− 4·03	
V_d	+ ·03		− ·16		− ·21		− ·21		− ·18		− ·18		− ·13	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	−20·2		− 4·7		−20·9		−19·9		−23·1		−18·7		−15·9	

MEASURES OF ι CYGNI—(Concluded).

λ	1845.		1886.											
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861·527......	−17·99	½	−37·58	½	....	...	....	...	....	...	....	...	....	...
4304·634......	−22·34	1	11·48	1	....	...	....	...	....	...	....	...	....	...
4101·890......	+ 1·90	½	1·21	1	....	...	....	...	....	...	....	...	....	...
3933·825......	−19·32	1	33·29	½	....	...	....	...	....	...	....	...	....	...
Weighted Mean......	−16·57		−14·37...		....		....		....		....		....	
V_a	− 4·24		− 7·31...		....		....		....		....		....	
V_d	− ·05		− ·09...		....		....		....		....		....	
Curv.	− ·28		− ·28...		....		....		....		....		....	
Radial Velocity...	−21·1		−22·0 ...		... .		....		....		....		....	

SUMMARY OF MEASURES OF ι CYGNI

Plate.	Date.	Vel.	Plate.	Date.	Vel.
932	July 9 1907........	−20·2	1824	August 24 1907........	−18·7
1718	" 15 "	− 4·7	1839	" 27 "	−15·9
1804	August 20 "	−20·9	1845	" 28 "	−21·1
1804	" 20 "	−19·9	1886	September 14 "	−22·0
1824	" 24 "	−23·1			

α OPHIUCHI

This star was under observation during the summer of 1908, when twenty-four plates were taken. These were all measured and considerable range was found in the velocities obtained. The lines, however, are all broad and it is hard to get satisfactory agreement in the measurement of them. The lines appearing are the hydrogen lines β, γ, δ and ϵ, the magnesium line λ 4481, and the calcium K. It may be stated that the magnesium line was measured in many cases but does not appear in the measures following, for the reason that it differed to such a degree from the other lines. Whether this is a real difference or an error due to the character of the line it is hard to say. More plates will probably be taken and an attempt made to solve the system.

P —Plaskett.
H —Harper.
P[1]—Parker.
C —Cannon.

RECORD OF SPECTROGRAMS

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure. G.M.T.	Duration.	Hour Angle at End.	Temperature Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1908	h m	m	h m								
α Ophiuchi.	1481	I L	Seed 27	Apr. 13	20 35	16	0 20 W	1·0	0·0	8·0	8·0	·0018	Good.......	H	
"	1542	"	"	May 18	19 52	19	1 15 W	16·0	15·5	23·4	23·4	·0016	"	H	
"	1549	"	"	" 22	19 59	20	1 37 W	19·0	19·0	25·0	25·0	·0017	"	H	
"	1612	"	"	June 17	19 37	15	3 00 W	14·5	14·4	21·8	21·6	·0016	"	P[1]	
"	1632	"	"	" 24	17 42	10	1 30 W	19·2	19·0	27·5	27·5	·0015	"	P	
"	1649	"	"	" 27	17 45	10	1 40 W	19·8	19·5	23·7	23·6	·0014	"	P	
"	1654	"	"	July 1	17 50	10	2 05 W	19·7	19·6	25·8	25·7	·0015	Fair........	P	
"	1688	"	"	" 10	17 07	14	1 55 W	21·0	20·5	27·4	27·3	·0016	Good........	H	
"	1701	"	"	" 13	17 51	13	2 49 W	18·8	18·7	23·0	23·0	·0015	Fair........	P	
"	1702	"	"	" 13	18 13	22	3 15 W	18·7	18·5	23·0	"	"	"	P-P[1]	
"	1715	"	"	" 15	18 57	12	4 06 W	14·5	14·5	22·0	22·0	"	Good.......	H	
"	1724	"	"	" 24	14 39	11	21 W	23·0	23·0	26·2	26·2	·0016	"	H	
"	1752	"	"	" 31	16 13	13	2 30 W	20·0	19·6	26·0	26·0	·0015	"	P[1]	
"	1765	"	"	Aug. 5	16 00	13	2 28 W	21·6	21·6	26·9	26·9	"	....	P	
"	1819	"	"	" 24	14 42	14	2 27 W	17·0	17·0	23·2	23·4	"	"	H	
"	1834	"	"	" 27	13 09	12	1 04 W	19·4	19·0	23·6	23·4	"	"	C	
"	1843	"	"	" 28	13 31	12	1 32 W	18·3	18·5	23·2	23·2	"	"	C	
"	1854	"	"	" 31	14 38	17	2 53 W	22·0	21·5	27·8	28·0	"	Fair........	H	
"	1862	"	"	Sept. 3	13 11	15	1 40 W	18·8	18·0	21·1	21·0	"	Good.......	P	
"	1863	"	"	" 3	13 27	15	1 57 W	18·0	17·8	21·0	"	"	"	P	
"	1884	"	"	" 14	13 26	15	2 38 W	18·2	17·8	21·7	21·6	"	Fair........	P	
"	1885	"	"	" 14	13 46	18	3 00 W	17·8	17·0	21·6	"	"	"	P	
"	1890	"	"	" 16	12 46	23	2 10 W	19·5	19·0	21·7	21·7	"	"	P	
"	1891	"	"	" 16	13 12	25	2 35 W	19·0	18·2	"	21·6	"	"	P	

MEASURES OF α OPHIUCHI

λ	1481.		1542.		1542.		1549.		1612.		1612.		1632.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861·527......	−13·06	½	+ 6·52	½	− 7·25	½	+11·75	¼	.....	...	....	...	+29·16	½
4549·766......	−21·43	½	....	...	....	...	....	...	.....	...	....	...	....	...
4481·400......	−29·00	½	....	...	−11·86	½	....	...	.....	...	....	...	....	...
4340·634......	−26·00	1	+ 2·71	1	−11·53	1½	+31·11	1	+28·08	1	+32·57	¾	+43·01	1
4101·890......	+ 8·76	½	+ 0·87	1	− 6·03	1	− 3·30	½	− 4·07	1	+17·36	½	+13·10	1
3933·825......	....	...	+23·21	½	+ 6·44	¼	....	...	....	...	....	...	+ 9·04	1
Weighted Mean.......	−17·79		+ 6·14		− 9·17		+18·51		+12·00		+ 8·27		+23·07	
V_o	+13·24		+ 9·67		+ 9·67		+ 8·16		− 2·17		− 2·17		− 4·92	
V_d	·00		− ·09		− ·09		− ·12		− ·21		− ·21		− ·12	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Vel...	...− 4·8		+15·4		+ 0·1		+16·3		+ 9·3		+ 5·6		+17·7	

MEASURES OF α OPHIUCHI—(*Continued*).

λ	1649.		1654.		1688.		1701.		1702.		1715.		1724.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861·527......	+29·16	½	+21·04	½	+21·47	½	....	...	+24·95	½	+28·58	½	+22·49	½
4340·634......	+27·35	½	+26·52	1½	+16·70	1	+12·21	1	+ 3·96	½	+ 3·86	1	+ 0·63	¼
4101·890......	+ 6·77	½	+23·78	1	+34·72	1	+ 1·64	½	−10·15	½	− 1·13	½	+52·42	½
3933·825......	+17·15	1	+15·43	¼	....	...	+20·82	½	+ 1·72	½	+30·56	½	+30·56	1
Weighted Mean.......	+19·51		+23·98		+24·86		+11·72		+ 5·12		+13·15		+30·30	
V_o	− 5·98		− 7·63		−11·00		−12·01		−12·01		−12·72		−15·58	
V_d	− ·12		− ·15		− ·14		− ·22		− ·22		− ·28		− ·02	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Vel...	+13·1		+15·9		+13·4		− 0·8		− 7·3		− 0·1		+14·4	

MEASURES OF α OPHIUCHI—(*Continued*).

λ	1752. Vel.	Wt	1765. Vel.	Wt	1819. Vel.	Wt	1819. Vel.	Wt	1834. Vel.	Wt	1843. Vel.	Wt	1854. Vel.	Wt
4861·527......	+34·10	½	+25·39	½	+39·47	½	+13·92	½	+14·95	½	+54·70	½	+79·08	½
4340·634......	+ 4·17	1	+35·45	1½	+13·36	1	+ 3·54	1	+30·59	1	+47·50	1	+44·47	1
4101·890......	+36·30	½	+50·84	¼	+53·76	¼	+ 0·86	1	+19·01	½	+26·90	½	+31·07	¼
3933·825......	+19·02	¼	+25·02	1	....	...	+19·99	1	+33·33	½	+35·65	1	....	...
Weighted Mean.......	+19·61		+34·95		+26·60		+ 8·46		+25·69		+41·32		+52·45	
V_a	−17·72		−19·11		−22·66		−22·66		−23·05		−23·18		−23·49	
V_d	− ·19		− ·18		− ·18		− ·18		− ·09		− ·12		− ·21	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Vel...	+ 1·4		+15·4		+ 3·5		−14·7		+ 2·3		+17·7		+28·5	

MEASURES OF α OPHIUCHI—(*Concluded*).

λ	1862. Vel.	Wt	1863. Vel.	Wt	1884. Vel.	Wt	1885. Vel.	Wt	1885. Vel.	Wt	1890. Vel.	Wt	1891. Vel.	Wt
4861·527......	+21·33	½	+ 4·35	½	+37·00	½	+26·70	½	......	...	+23·07	½	+61·66	½
4340·634......	+42·70	½	+50·73	1	+11·17	½	+56·48	1	+62·74	1	+16·18	1	+14·92	¼
4101·890......	+22·05	¼	+62·49	½	+28·03	½	+65·71	½	+67·27	½	+26·90	½	+ 8·50	½
3933·825......	+38·05	½	+42·69	½	+32·13	½	+32·06	½	.....	.	+28·38	1	+13·78	½
Weighted Mean.......	+32·31		+42·20		+27·33		+47·48		+64·25		+23·18		+26·15	
V_a	−23·58		−23·58		−24·02		−24·02		−24·02		−21·80		−21·80	
V_d	− ·12		− ·14		− ·21		− ·21		− ·21		− ·15		− ·15	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Vel...	+ 8·3		+18·2		+ 2·8		+23·0		+39·7		+ 0·9		+ 3·9	

SUMMARY OF MEASURES OF α OPHIUCHI

Plate No.	Date.	Vel.	Plate No.	Date.	Vel.
1481	April 13, 1908	− 4·8	1752	July 31, 1908	+ 1·4
1542	May 18 "	+15·4	1765	Aug. 5 "	+15·4
	" 18 "	+ 0·1	1819	" 24 "	+ 3·5
1549	" 22 "	+16·3		" 24 "	−14·7
1612	June 17 "	+ 9·3	1834	" 27 "	+ 2·3
	" 17 "	+ 5·6	1843	" 28 "	+17·7
1632	" 24 "	+17·7	1854	" 31 "	+28·5
1649	" 27 "	+13·1	1862	Sept. 3 "	+ 8·3
1654	July 1 "	+15·9	1863	" 3 "	+18·2
1688	" 10 "	+13·4	1884	" 14 "	+ 2·8
1701	" 13 "	− 0·8	1885	" 14 "	+23·0
1702	" 13 "	− 7·3		" 14 "	+39·2
1715	" 15 "	− 0·1	1890	" 16 "	+ 0·9
1724	" 24 "	+14·4	1891	" 16 "	+ 3·9

σ Cassiopeiae

This star was under observation here during the summer and fall of 1909. A number of plates were taken and measured. The spectrum is of the helium type—hydrogen, helium, the calcium *K*, and one or two faint iron lines showing. The lines are all broad and ill-defined and measures on them are liable to be greatly in error.

P —Plaskett.
H —Harper.
P¹—Parker.
C —Cannon.

RECORD OF SPECTROGRAMS

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure. G.M.T.	Duration.	Hour Angle at End.	Temperature Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1909	h m	m	h m								
σ Cassiopeiæ	2660	I	Seed 27	July 14	19 35	60	1 20 E	18·6	17·5	26·2	26·2	·002	Fair........	P	
"	2680	"	"	" 27	19 00	70	1 00 E	21·6	21·0	29·0	29·2	"	"	C	
"	2784	"	W&W X	Sept. 14	13 40	90	2 58 E	24·5	22·0	27·4	27·2	"	3..........	H	
"	2839	"	Seed 27	Oct. 4	15 45	60	22 W	13·8	13·1	23·21	23·00	"	5...........	C	
"	2902	"	"	" 20	16 47	65	2 15 W	2·0	2·0	6·9	6·8	"	5–3–4.......	P¹	
"	3009	"	"	Dec. 2	10 00	72	3 20 W	0·5	0·0	2·2	2·0	"	4–0.........	P¹	
				1910											
"	3521	"	"	July 11	18 32	76	2 30 E	19·0	17·5	27·0	26·8	"	3–4–5.......	C	
"	3527	"	"	" 13	17 37	55	3 27 E	20·5	19·5	25·5	25·3	....	5...........	P¹–C	

MEASURES OF σ CASSIOPEIAE.

λ	2660.		2680.		2784.		2839.		2839.		2902.		2902.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861·527					−88·95	¼	+ 5·77	½	−11·86	½				
4471·676	−60·90	¼	−50·69	½	−54·23	¼	+ 5·81	½	+ 2·65	½	−48·60	1	−45·44	1
4404·927			−45·87	½							−24·98	½	−31·31	¼
4388·100	−75·34	¼			+ 2·27	½								
4340·634	−26·08	1	−27·35	1	−15·46	1	− 6·46	½	+10·96	½	+ 4·51	½	+ 1·50	¼
4282·722													−45·99	¼
4143·928	−30·12	½	−65·20								−17·41	¼	−29·75	¼
4121·016	−39·63	½	−33·03	1										
4101·890	−25·63	1	−19·68	¼	−30·62	¼	−15·07	½	−10·75	½				
4026·352	−53·34	1	−60·01	½	−69·02	½	− 5·76	½					− 7·83	¼
4009·417	−40·36	¼									−54·74	¼		
3933·825	−34·03	½	−46·29	¼			− 3·15	½	−13·23	½	− 7·06	¼	− 2·49	¼
Weighted Mean	−38·30		−40·34		−33·56		− 3·15		− 4·45		−28·59		−29·92	
V_a	+17·20		+18·78		+17·08		+ 8·34		+ 8·34		+ 0·23		+ 0·23	
V_d	+ ·10		+ ·07		+ ·17		·00		·00		− ·08		− ·08	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−21·3		−21·8		−16·6		+ 4·9		+ 3·6		−28·7		−30·0	

MEASURES OF σ CASSIOPEIAE—(*Concluded*).

λ	3009.		3521.		3527.									
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4481·400	−21·02	½												
4471·676	−22·65	½												
4404·927	−17·33	¼			+17·79	¼								
4340·634	−39·30	½	−34·97	½	− 1·85	½								
4250·616	−19·47	¼												
4143·928			+17·40	½	+15·11	½								
4101·890			−11·23	¼	+32·26	½								
4026·352			+ 6·85	½										
3933·825			−26·56	1	−44·43	1½								
Weighted Mean	−25·34		−12·63		−44·43*									
V_a	−13·11		+18·78		+18·88									
V_d	− ·12		+ ·14		+ ·18									
Curv.	− ·28		− ·28		− ·28									
Radial Velocity	−38·8		+ 6·0		−25·6									

* Last line only.

SUMMARY OF MEASURES OF σ CASSIOPEIAE

Plate No.	Date.	Vel.	Plate No.	Date.	Vel.
2660	July 14, 1909..........	−21·3	2902	Oct. 20, 1909..........	−28·7
2680	" 27 "	−21·8		" 20 "	−30·0
2784	Sept. 14 "	−16·6	3009	Dec. 2 "	−38·8
2839	Oct. 4 "	+ 4·9	3521	July 11, 1910..........	+ 6·0
	" 4 "	+ 3·6	3527	" 13 "	−25·6*

9 Camelopardalis.

Four plates of this star were taken and measured here in the autumn of 1909. The spectrum shows quite a large number of lines due to hydrogen, helium and calcium, and a few faint ones due to iron, together with the lines λλ 4096 and 4089. The interesting thing about the star is the fact that the calcium lines *H* and *K* show velocities different from the other lines. Observations were being taken of this star at the Yerkes Observatory, and our measures of it were sent to them and consequently it was dropped from our list.

* One line—*K*.

C—Cannon.
P¹—Parker.

RECORD OF SPECTROGRAMS

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure. G.M.T.	Duration.	Hour Angle at End.	Temperature. Room. Beg.	Temperature. Room. End.	Temperature. Prism Box Beg.	Temperature. Prism Box End.	Slit Width.	Seeing.	Observer.	Remarks.
				1909	h m	m	h m								
9 Camelop.	2805	I	Seed 27	Sept. 20	18 44	42	2 45 E	11·5	11·7	20·3	20·2	·002	5........	C	
"	2842	"	"	Oct. 4	17 43	53	2 45 E	12·0	11·0	22·85	23·0	"	5........	C	
"	2874	"	"	" 8	18 52	46	1 15 E	14·1	12·4	22·6	22·7	"	5........	P¹	
"	2875	"	"	" 8	19 36	38	35 E	12·4	12·7	22·7	"	"	5........	P¹	

MEASURES OF 9 CAMELOPARDALIS

λ	2805.		2842.		2874.		2874.		2875.		2875.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527	.....	....	−17	½	....	....	−57	¼	−16	¼	−40	¾
4471·676	+23·6	½	−21	½	+15	1	+18	¾	−19	½	−20	¾
4437·718	......	....	....	....	−14	¼	....	....	....	....	....	....
4388·100	+14·0	¼	....	....	....	....	....	....	....	....	....	....
4340·634	+12	1	+16	1	− 8	1	+20	½	− 1	1	− 3	1
4143·928	....	....	+34	½	....	....	....	....	....	....	....	....
4116·4	−13	1	−19	¼	−31	¼	....	....	−18	¼	....	....
4101·890	−21	½	+29	¼	−23	1	+19	½	+12	½	+25	¼
4096·9	+24	½	+48	¼	....	....	....	....	....	....	....	....
4089·1	−24	½	− 5	¼	−15	½	−23		−24	¼	−40	¼
4026·352	−21	½	+25	½	− 8	½	−21	½	....	....	....	....
3970·177	....	....	− 5	½	+13	½	....	....	+17	¼	....	....
3968·625	−28	1	−23	1	−25	1	−25	1	−30	1½	−30	1½
3933·825	−27	½	−14	1½	−13	1½	−18	1½	−21	1	−23	1½
*Weighted Mean..	−27·50		−17·60		−17·60		−20·80		−26·40		−26·50	
V_a	+21·28		+19·95		+19·35		+19·35		+19·35		+19·35	
V_d	+ ·10		+ ·10		+ ·04		+ ·04		+ ·04		+ ·04	
Curv	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	− 6·4		+ 2·2		+ 1·5		− 1·7		− 7·3		− 7·4	

SUMMARY OF MEASURES OF 9 CAMELOPARDALIS

Plate.	Date.	Vel.	Plate.	Date.	Vel.
2805	September 20, 1909. ...	− 6·4	2874	October 8, 1909	− 1·7
2842	October 4 "	+ 2·2	2875	" 8 "	− 7·3
2874	" 8 "	+ 1·5	"	" 8 "	− 7·4

* Last two lines only.

APPENDIX C.

THE ORBIT OF ω URSAE MAJORIS. MEASURES OF ζ AQUILAE AND ν CYGNI.

T. H. Parker, M.A.

The Orbit of ω Ursae Majoris.

The star ω Ursae Majoris ($\alpha = 10^h 48^m$, $\delta = +43° 43'$, phot. mag. 4.8) was announced as a spectroscopic binary by Vogel in 1903.* It was included in a list of 528 stars whose spectra were investigated by Vogel and Wilsing at Potsdam. Vogel states that on one plate he found an indication of the doubling of the K line, and the Mg line λ 4481 doubled on one or two others.

It was first observed here in Feb. 1908 and since then sixty-nine spectrograms have been obtained—fifteen with the old, and the remainder with the new single-prism spectrograph. This star is an A type, according to the Harvard classification, the principal lines measured being the Mg λ 4481, the hydrogen series and K. Only three of the plates obtained here show definite double lines. This is probably due to the faintness of the secondary component, whose mass as seen later is only about one-sixth that of the primary, as well as to insufficient dispersion in separating the two spectra. The length of exposure required for a star of this magnitude forbade the use of the three-prism instrument. On this account also Seed 27 plates were used for the majority of the spectrograms. Six were taken, however, on Seed 23, and the finer grain gave a much better spectrum. The average length of exposure required for these was 90 minutes. The blending of the lines of the two spectra made the measurement of the plates rather unsatisfactory. In one plate in which the lines were separated, those which showed doubling were the Mg line λ 4481 and the two iron lines λ 4325 and λ 4308. In another, the lines λ 4308 and λ 4101 (H_δ) were found to be doubled, with faint indications also of a secondary spectrum in iron lines λ 4549, λ 4325 and λ 4260. In the third plate, only λ 4308 was measurable. No trace of a doubling of the K line was found on any of our plates.

The lines measured were as follows:—

Elements.	Wave-Length.	No. of times measured.
H_β........................	4861·527	12
Fe........................	4549·766	46
Mg........................	4481·400	69
H_γ........................	4340·634	58
Fe........................	4325·939	5
Fe........................	4233·328	7
Si........................	4128·211	9
H_δ........................	4101·890	33
Ca (K)........................	3933·825	39

* Astronomische Nachrichten, 163, p.145, 1903.

The hydrogen lines with the exception of H_γ are broad and diffuse. The *Mg* λ 4481 is the best line in the spectrum and was measured on every plate, as will be seen in the table above. Metallic lines other than *Mg* λ 4481, *Fe* λ 4549 and *K* do not occur frequently. As different lines on the same plate in many cases gave widely differing velocities, the determination of the period offered some difficulty. Several such plates were re-measured or 'checked' by other observers, and the resulting means taken. These measures were usually in fair agreement. From the consideration of the velocities of the *Mg* line alone, the period was found to be between fifteen and sixteen days. Several trials using the velocities of whole plates gave 15.84 days as the most satisfactory period.

Following is the record of observations and detailed measures of the plates, and this is followed by a summary of the measures containing the velocities and the phases and residuals from the final elements.

P—Plaskett.
H—Harper.
P[1]—Parker.
C—Cannon.

RECORD OF SPECTROGRAMS

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure. G.M.T.	Duration.	Hour Angle at End.	Temperature Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width in Inches.	Seeing.	Observer.	Remarks.
				1908	h m	m	h m								
ω Ursæ Majoris	1340	I L	Seed 27	Feb. 21	17 15	43	1 47 W	− 5·0	− 5·5	0·8	0·7	·0016	Fair........	H	
"	1386	"	"	Mar. 9	17 07	55	55 W	−10·5	− 9·5	0·4	0·9	"	Fair........	P	Off 10 min.
"	1489	"	"	Apr. 15	16 42	45	2 50 W	0·0	− 2·0	8·0	8·0	"	Good.......	H	
"	1499	"	"	" 17	14 32	25	30 W	6·5	6·0	10·8	10·8	"	Fair........	P	Clouded over
"	1537	"	"	May 18	15 52	45	4 15 W	19·8	19·0	23·4	23·4	"	Fair........	P	
"	1579	"	"	June 5	15 45	64	5 23 W	19·0	19·0	24·7	24·7	"	Fair........	H	
"	1637	"	"	" 26	14 55	90	6 11 W	22·5	21·0	30·0	30·0	"	Good.......	H-C	
"	2021	"	"	Dec. 9	22 34	52	23 W	− 2·0	− 2·0	− 2·4	− 2·0	·0015	Fair........	C	
"	2037	"	"	" 16	22 30	50	45 W	−11·0	−11·8	2·8	2·8	"	Good.......	C	
"	2063	"	"	" 21	22 24	61	1 05 W	−15·5	−15·5	− 1·9	− 1·9	"	"	C	
				1909											
"	2099	"	"	Jan. 6	21 24	62	1 10 W	−19·0	−19·8	− 3·7	− 3·3	"	"	C	
"	2232	"	"	Feb. 3	19 22	75	1 05 W	−12·0	−12·0	− 4·0	− 4·0	·0016	Very Hazy..	C	
"	2259	"	"	" 8	19 05	50	53 W	−17·0	−17·0	− 5·3	− 5·3	"	Fair........	H	
"	2299	"	"	" 22	18 10	70	1 00 W	− 4·0	− 3·9	1·0	1·0	"	Hazy.......	C	
"	2321	"	"	Mar. 3	18 00	70	1 35 W	− 5·2	− 5·6	− 0·9	− 0·6	"	"	C	
"	2354	I	"	" 12	16 22	45	15 W	− 0·6	− 0·6	2·8	2·8	·0018	Good.......	C	
"	2369	"	"	" 13	16 39	42	35 W	− 0·4	− 0·5	3·2	3·1	·002	"	P	
"	2411	"	"	" 22	16 47	35	1 15 W	0·0	− 0·9	5·5	5·4	"	"	P[1]	
"	2431	"	"	" 23	17 15	30	1 40 W	0·0	− 0·5	7·6	7·6	"	....	C	
"	2447	"	"	" 31	16 07	35	1 05 W	6·0	6·0	10·0	9·5	"	....	H	
"	2466	"	"	Apr. 1	18 52	35	4 00 W	− 0·3	− 0·6	8·2	8·2	"	Hazy.......	P[1]	
"	2480	"	"	" 8	15 00	40	40 W	4·5	4·0	8·1	8·0	"	....	P	
"	2494	"	"	" 12	15 11	32	1 00 W	9·5	9·5	10·8	10·8	"	Fair........	C	Clouded over
"	2500	"	"	" 19	17 15	50	3 35 W	3·8	3·2	6·4	6·4	·0015	"	P[1]	
"	2508	"	"	" 23	15 38	43	2 15 W	4·5	3·5	10·8	10·6	·002	Good.......	C	
"	2520	"	"	" 26	16 23	43	3 15 W	5·0	4·8	9·3	9·3	"	"	P[1]	
"	2535	"	"	May 3	13 49	42	1 05 W	7·5	6·9	8·0	7·9	"	Hazy.......	P[1]	
"	2549	"	"	" 24	15 22	45	4 05 W	17·0	15·0	22·75	22·7	"	....	P	
"	2551	"	"	" 26	16 32	55	5 20 W	18·0	17·6	23·2	23·2	"	Cloudy.....	P[1]	

“	2552	“	“	“	31	16	37	45	5	45	W	18·0	16·5	21·2	21·0	“	Good........	P	
“	2557	“	“	June	2	14	22	105	4	10	W	20·9	20·8	27·0	27·0	“	Poor........	P	
“	2571	“	W & W Extra Speedy	“	15	16	02	95	6	30	W	17·2	16·8	21·3	21·2	“	Poor........	P¹	
“	2583	“	“	“	24	15	17	55	6	05	W	25·1	24·0	28·2	28·1	“	Fair........	P	
“	2878	“	Seed 27	Oct.	8	21	45	46	3	30	E	11·7	11·8	22·7	22·5	“	4..........	P¹	On scale of 5.
“	2959	“	“	Nov.	15	21	35	56	2	10	E	0·5	2·0	15·9	14·7	“	5–3.........	P¹	
				1910															
“	3112	“	“	Jan.	14	19	30	51		20	E	−14·5	−15·4	− 8·8	− 9·0	“	4..........	P¹	
“	3144	“	“	“	25	20	03	55		55	W	− 7·1	− 7·8	− 3·3	− 3·4	“	4..........	P	
“	3161	“	“	“	31	17	10	60	1	30	E	− 9·0	−10·0	1·8	1·6	“	4–5.........	C	
“	3198	“	“	Feb.	18	16	30	67	1	00	E	−14·5	−15·3	2·7	2·8	“	3–4.........	H	
“	3205	“	“	“	21	16	52	55		28	E	− 6·8	− 7·5	2·7	2·7	“	4–5.........	C	
“	3212	“	“	“	23	17	21	38		00		−14·1	−14·1	− 4·6	− 4·6	“	5..........	P¹	
“	3248	“	“	“	28	16	30	60		20	E	2·5	2·3	9·6	9·2	“	4–5.........	C	
“	3282	“	“	Mar.	3	19	21	77	2	55	W	− 1·0	− 1·8	7·8	7·6	“	3–2.........	C	
“	3321	“	“	“	11	15	16	50		56	E	1·0	1·0	6·0	6·0	“	5..........	H	
“	3340	“	“	“	18	13	35	50	2	10	E	− 0·5	− 2·0	3·0	2·8	“	4..........	H	
“	3353	“	“	“	16	16	45	96	1	10	W	− 9·0	− 7·9	4·0	3·7	“	4–0.........	P¹	
“	3357	“	“	“	23	16	12	55		50	W	2·5	0·2	9·0	8·8	“	3..........	P¹	
“	3364	“	“	“	28	16	20	80	1	30	W	11·4	10·3	18·7	18·5	“	4–5.........	C	
“	3377	“	“	Apr.	8	16	00	60	1	45	W	6·0	4·5	17·4	17·2	·0025	3–4.........	P¹	
“	3388	“	“	“	12	19	37	50	5	45	W	− 0·7	− 1·0	6·8	6·8	·002	4..........	P¹	
“	3391	“	“	“	13	14	40	49		30	W	7·6	7·0	10·0	9·9	“	3–0.........	P¹	
“	3395	“	“	“	14	15	30	90	1	50	W	10·0	9·6	12·1	12·1	“	2–3–4.......	P	
“	3397	“	“	“	20	16	02	75	2	45	W	12·2	10·7	15·9	15·9	“	0–3.........	P¹	
“	3406	“	“	“	25	15	01	47	1	45	W	15·5	15·1	17·0	16·85	“	4–2.........	C	
“	3407	“	“	“	27	15	03	63	2	10	W	5·0	3·5	14·8	14·7	“	4..........	P¹	
“	3416	“	“	“	28	14	16	50	1	12	W	6·0	6·0	11·1	10·0	“	4..........	H	
“	3422	“	“	May	5	13	10	50		45	W	12·3	11·5	14·4	14·4	“	3–4.........	P	
“	3441	“	“	“	11	15	20	60	3	15	W	9·0	7·4	16·2	16·4	“	4–2–4.......	C	
“	3454	“	“	“	19	15	40	60	4	00	W	12·5	11·9	18·2	18·0	“	3–4.........	P	
“	3866	“	Seed 23	Dec.	9	23	10	90	1	28	W	−14·5	−15·0	− 4·9	− 4·5	“	4–5.........	H	
“	3893	“	“	“	21	21	07	81		4	E	−19·0	−19·0	− 0·9	− 1·1	“	4–5.........	H	
				1911															
“	4094	“	“	Mar.	10	19	49	91	3	55	W	− 5·9	− 6·9	4·4	4·6	“	4–5.........	P¹	
“	4182	“	“	Apr.	10	18	52	95	5	00	W	1·1	− 0·4	10·0	9·9	“	5..........	P¹	
“	4231	“	“	“	21	16	49	85	3	35	W	3·4	2·6	11·7	11·5	“	4..........	P¹–C	
“	4267	“	“	“	26	18	30	90	5	33	W	11·0	10·4	20·3	20·3	“	5..........	C	

MEASURES OF ω URSAE MAJORIS

λ	1340.		1340.*		1386.		1386.*		1489.		1489.*		1499.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel	Wt	Vel.	Wt
4549......	+ 0·48	1	− 8·19	½	...		...		...		...		...	
4481......	− 4·26	2	− 9·65	2	− 6·56	1½	−12·43	1	−14·27	1½	−12·72	½	+17·26	2
4340......	−17·23	1½	−16·81	1	−12·01	1½	−13·78	½	−19·94	1½	−15·45	1	...	
4233......	− 9·45	1	...		...		...		...		...		...	
4128......	+ 4·43	½	...		...		...		...		...		...	
4101......	−13·19	1	...		−16·93	1	...		−17·88	1	−23·93	1	...	
3933......	...		...		−16·63	1	...		−23·74	2	−33·56	2	...	
Weighted Mean.......	− 7·76		−11·48		−12·28		−12·89		−19·44		−23·84		+17·26	
V_a	− 2·79		− 2·79		−11·33		−11·33		−21·45		−21·45		−21·82	
V_d	− ·10		− ·10		− ·03		− ·03		− ·15		− ·15		− ·01	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	−10·9		−14·6		−23·9		−24·5		−41·3		−45·8		−4·8	

MEASURES OF ω URSAE MAJORIS—(*Continued*).

λ	1499.*		1537.		1537.*		1579.		1579.*		1637.		2021.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861..........	...		...		...		−15·09	½	−19·88	½	...		...	
4549..........	...		...		...		−15·89	½	−15·29	¼	+ 2·95	1	−61·28	½
4481..........	+14·85	1	+ 4·60	2	+ 7·13	1½	+10·13	2	+14·15	1	− 3·90	2	−61·31	1
4340..........	...		...		...		+ 0·52	½	− 6·68	¼	...		...	
4233..........	...		...		...		−19·38	1	...		...		...	
3933..........	...		...		...		− 4·04	1	− 0·52	½	...		...	
Weighted Mean......	+14·85		+ 4·60		+ 7·13		− 3·35		− 0·68		− 1·62		−61·30	
V_a	−21·82		−24·63		−24·63		−23·18		−23·18		−20·18		+23·29	
V_d	− ·01		− ·17		− ·17		− ·22		− ·22		− ·21		− ·03	
Curv..	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity..	− 7·2		−20·5		−17·9		−27·0		−24·4		−22·3		−38·3	

* Check measurement.

MEASURES OF ω URSAE MAJORIS—(*Continued*).

λ	2037.		2063.		2099.		2232.		2259.		2299.		2321.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861	...	...	−55·83	½	...	...	−22·89	½	...	...	−11·77	½	+18·74	½
4549	−23·82	1	−73·87	½	−47·27	1	−19·34	2	−18·44	½	−46·31	½	+ 5·91	1
4481	−21·11	1½	−42·77	2	−36·61	1½	−17·74	2	−28·43	1	−21·30	1	+ 8·89	1
4340	−26·76	1	−40·76	1	−29·30	1	−16·48	1	...	...	−14·33	1	+13·40	½
4101	...	...	−57·20	½	−54·09	½	−22·14	½	...	...	−26·60	½	...	...
3933	−30·24	½	−52·54	1½	−41·33	1	− 6·03	1	...	...	−21·61	2	+ 2·71	1
Weighted Mean	−24·34		−49·76		−39·97		−17·03		−25·20		−22·05		+ 8·39	
V_a	+21·91		+20·72		+21·61		+ 4·70		+ 2·58		− 3·54		− 7·36	
V_d	− ·03		− ·03		− ·03		− ·03		− ·03		− ·03		− ·07	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 2·74		−29·3		−18·7		−12·7		−22·9		−26·0		+ 0·7	

MEASURES OF ω URSAE MAJORIS—(*Continued*).

λ	2354.		2369.		2411.		2431.		2447.		2466.		2480.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4549	...	...	...	...	...	...	+10·67	1	...	...	...	...	− 4·27	1
4481	−15·94	1	−25·43	1½	+ 0·93	1	+19·69	1	+ 1·08	2	− 4·33	2	−12·19	1
4340	−28·69	1	−14·89	1½	+ 2·54	1	− 0·40	1	− 1·50	1	− 0·75	1	− 5·55	1
4101	−30·14	1	−18·20	1	...	...	...	...	+ 1·64	½	...	...	− 7·70	½
3933	−18·39	1	−15·22	1	...	...	...	...	...	...	...	...	+ 5·02	½
Weighted Mean	−23·29		−18·78		+ 1·72		+10·00		+ 0·42		− 3·14		− 5·84	
V_a	−10·95		−11·34		−15·21		−16·00		−17·54		−17·87		−19·74	
V_d	·00		·00		− ·07		− ·10		− ·07		− ·19		− ·03	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−34·5		−30·4		−13·8		− 6·4		−17·5		−21·5		−26·1	

MEASURES OF ω URSAE MAJORIS—(*Continued*).

λ	2494.		2500		2508.		2520.		2525.		2535.		2549.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4549					+10·94	1	−13·34	½					+14·67	
4481	−12·56	1	+21·76	1	+26·79	1	− 8·99	1	−26·90	1	+17·47	1	+23·71	1½
4340	− 6·57	¾	+28·00	1	+ 9·49	½	−10·17	1	−21·98	1	+15·15	½	+26·61	1½
4101							−10·50	½						
Weighted Mean	−11·36		+24·88		+16·96		−10·36		−24·44		+16·70		+23·17	
V_a	−20·72		−22·15		−22·99		−23·31		−23·69		−23·27		−24·41	
V_d	− ·06		− ·18		− ·15		− ·18		− ·10		− ·05		− ·19	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−32·4		+ 2·3		− 6·4		−34·1		−48·5		− 6·9		− 1·7	

MEASURES OF ω URSAE MAJORIS—(*Continued*).

λ	2549.*		2551.		2552.		2557.		2571.		2583.		2878.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4549	+20·11	¼	+ 3·87	¼	−31·95	½	− 9·98	½	−24·01	½			−40·36	½
4481	+21·28	¾	+23·71	1	− 9·69	1	−20·10	½	−15·44	½	+18·42	2	−35·53	1
4340	+26·36	1			− 3·01	½	−15·92	¼			+22·35	1	−46·12	½
4233	+20·31	¼												
Weighted Mean	+23·30		+19·75		−13·58		−15·22		−19·72		+19·73		−39·38	
V_a	−24·41		−24·26		−23·82		−23·61		−21·50		−19·96		+19·48	
V_d	− ·19		− ·23		− ·25		− ·18		− ·25		− ·25		+ ·21	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 1·6		− 5·1		−37·9		−39·3		−41·7		− 0·6		−20·0	

* Check measurement.

MEASURES OF ω URSAE MAJORIS—(Continued).

λ	2959.		3112.		3112.*		3144.		3144.*		3161.		3198.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861									−40·31	½				
4549	−37·80	½	−14·41	1	−11·33	½	−33·55	½	−31·48	1				
4481	−40·83	2	−13·15	1	−14·92	1	−47·30	1	−48·21	1	+ 8·83	1	−16·21	1½
4340	−28·58	1					−30·54	1	−33·20	1	+ 5·24	1		
4325	−25·92	¼												
4233							−34·21	½						
4101	−48·86	½					−27·25	¼	−31·01	½	+ 9·63	½		
3933	−38·67	½	−13·48	½	− 8·15	½	−39·44	½	−39·27	½	+ 3·33	½	−16·79	½
Weighted Mean	−37·78		−13·72		−12·32		−36·90		−37·37		+ 6·85		−16·35	
V_a	+25·23		+13·22		+13·22		+ 8·83		+ 8·83		+ 6·32		− 1·66	
V_d	+ ·15		+ ·04		+ ·04		− ·03		− ·03		+ ·12		+ ·10	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−12·7		− 0·7		+ 0·7		−27·8		−28·8		+13·0		−18·2	

MEASURES OF ω URSAE MAJORIS—(Continued).

λ	3205.		3212.		3248.		3282.		3321.		3321.*		3340.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4549			−39·09	1	−30·68	½	+11·72	¼	−27·31	1			+ 9·60	1
4481	−31·75	2	−34·07	½	−17·23	1	− 2·42	2	− 5·73	1	− 9·94	1	+ 7·08	2
4340	−34·01	½			−17·59	½	+ 5·09	1	− 8·90	1½	− 9·13	1	+15·38	1
4325					−17·86	½								
4101	−26·00	1					− ·28	½	−10·87	1			+ 7·22	1
3933	−33·11	1					+10·55	1	−27·92	1	−24·43	1		
Weighted Mean	−31·10		−37·95		−20·11		+ 3·18		−15·50		−14·50		+ 9·27	
V_a	− 2·85		− 3·85		− 5·97		− 7·26		−10·45		−10·45		−14·17	
V_d	+ ·04		+ ·03		+ ·06		− ·12		+ ·10		+ ·10		− ·15	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−34·2		−42·0		−26·3		− 4·5		−26·2		−25·2		− 5·3	

* Check measurement.

MEASURES OF ω URSAE MAJORIS—(*Continued*).

λ	3353.		3357.		3364.		3364.*		3375.		3375.*		3377.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861......	......		......		......		......		......		......		+ 4·65	½
4549......	− 2·93	½	......		......		−22·38	½	......		......		......	
4481......	+ 1·02	1	− 8·28	1	−12·74	2	−11·85	1	+27·39	1½	+22·06	1½	+ 4·83	1
4340......	+ 2·31	½	−13·75	½	− 8·79	1½	−10·98	1	+32·71	1½	+30·08	1	+11·08	1½
4233......	......		......		......		......		+12·07	1	......		......	
4128......	− 0·49	½	......		......		......		......		......		......	
4101......	......		......		......		......		+11·86	1	......		− 2·97	½
3933......	......		−14·62	¼	− 7·72	½	− 6·65	1	+18·28	1	......		−10·99	1
Weighted Mean......	+ ·20		−10·73		−10·63		−11·51		+22·06		+24·07		+ 2·52	
V_a	−12·39		−14·88		−16·54		−16·54		−19·16		−19·16		−19·70	
V_d	− ·03		− ·04		− ·06		− ·06		− ·06		− ·06		− ·08	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	−12·5		−25·9		−27·5		−28·4		+ 2·6		+ 4·6		−17·5	

MEASURES OF ω URSAE MAJORIS—(*Continued*).

λ	3377.*		3377.*		3388.		3388.*		3391.		3391.*		3395.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861..........	......		......		−27·76	¼	......		......		......		......	
4549..........	......		......		− 9·46	½	......		−20·74	½	......		......	
4481..........	+ 0·76	½	− 2·42	1	−15·92	2	− 6·25	1½	−19·71	½	−19·10	½	− 4·50	1½
4340..........	+ 0·93	1	− 2·08	1	− 6·24	1	− 9·83	½	−12·92		......		− 2·23	1
4233..........	......		......		......		......		......		......		− 2·03	1
4128..........	......		......		......		......		......		......		− 9·63	½
4101..........	......		− 2·40	¼	......		......		......		......		− 7·89	½
3933..........	− 2·00	½	− 3·15	1½	−21·19	½	......		......		......		−10·55	½
Weighted Mean.......	+ 0·15		− 2·62		−14·20		− 7·14		−17·80		−19·10		− 5·01	
V_a	−19·70		−19·70		−20·75		−20·75		−20·95		−20·95		−21·12	
V_d	− ·08		− ·08		− ·25		− ·25		·00		·00		− ·07	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	−19·9		−22·7		−35·5		−28·3		−39·0		−40·3		−26·5	

*Check measurement.

MEASURES OF ω URSAE MAJORIS—(*Continued*).

λ	3395.*		3397.		3397.*		3406.		3407.		3407.*		3416.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4549	...	...	+18·90	½	+25·60	½	− 4·80	1	− 8·65	½	− 4·66	½	−14·38	½
4481	−16·70	1	+32·56	1½	+26·90	½	−12·72	1	−12·59	1	−19·08	1	−15·29	1
4340	− 9·49	½	+32·19	2	+27·07	1	− 4·50	2	+ 4·50	1	+ 6·57	1	−20·11	1
4233	...	...	+31·98	½	...	...	...	...	...	...	...	...	...	...
4128	...	...	...	...	...	...	− 2·55	¼	− 3·14	½	...	...	...	...
4101	...	...	+37·44	1	...	...	...	...	+ 6·05	½	+ 2·49	½	−14·52	½
3933	...	...	+45·12	1	...	...	−25·70	½	−23·10	1	−27·40	½	−17·95	1
Weighted Mean	−14·29		+35·60		+26·66		− 8·42		− 7·55		− 7·80		−16·95	
V_a	−21·12		−22·32		−22·32		−21·33		−23·41		−23·41		−23·53	
V_d	− ·07		− ·12		− ·12		− ·09		− ·12		− ·12		− ·07	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−35·8		+12·9		+ 4·0		−30·1		−31·3		−31·6		−40·8	

MEASURES OF ω URSAE MAJORIS—(*Continued*).

λ	3422.		3441.		3454.									
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4549	+39·56	1	...	...	+ 3·06	1	...	...	...	...	...	...	...	...
4481	+26·12	1	− 7·25	1	+26·38	½	...	...	...	...	...	...	...	...
4340	+32·45	1	− 8·08	1½	+17·34	1	...	...	...	...	...	...	...	...
4325	+30·40	½	...	...	...	...	...	...	...	...	...	...	...	...
4308	+13·64	½	...	...	...	...	...	...	...	...	...	...	...	...
4271	+13·24	½	...	...	...	...	...	...	...	...	...	...	...	...
4101	+11·63	½	...	...	+16·03	½	...	...	...	...	...	...	...	...
3933	+18·57	1	− 7·33	1	+ 1·08	½	...	...	...	...	...	...	...	...
Weighted Mean	+25·20		− 7·62		+12·05		...		...		...		...	
V_a	−24·24		−24·68		−24·63		...		...		...		...	
V_d	− ·02		− ·14		− ·19		...		...		...		...	
Curv.	− ·28		− ·28		− ·28		...		...		...		...	
Radial Velocity	+ 0·7		−32·7		−13·0		...		...		...		...	

*Check measurement.

MEASURES OF ω URSAE MAJORIS—(*Continued*).

λ	3866.		3866.*		3893.*P*		3893.*S*		4094.*P*		4094.*S*		4182.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861·527													−11·55	½
4549·766	−25·75	1	−23·74	1½			−56·34	½			−10·39	½	− 7·19	½
4481·400	−12·76	1	− 9·31	1	+58·86	⅛	−54·91	1			−10·83	1	− 7·14	½
4340·634													−15·69	½
4325·939			− 8·36	1	+80·99	⅛	−44·96	⅛						
4308					+117·98	¼	−51·03	¼	+104·32	...	−20·77	½		
4128·211			− 4·19	½										
3933·825	−19·47	½	−16·39	1							−27·84	½	−10·13	½
Weighted Mean	−19·28		−15·32		+93·94		−54·61		+104·32		−16·12		−10·34	
V_a	+22·83		+22·83		+20·86		+20·86		− 20·18		−20·18		−20·17	
V_d	− ·09		− ·09		+ ·07		+ ·07		− ·18		− ·18		− ·28	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 3·2		+ 7·2		+114·6		−34·0		+ 83·7		−36·8		−31·1	

MEASURES OF ω URSAE MAJORIS—(*Concluded*).

λ	4231.		4267.											
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861·527	+23·91	¼	−13·47	¼										
4549·766	+ 7·59	1	− 4·92	½										
4481·400	+20·38	1	− 8·90	1										
4340·634	+ 8·09	½	+ 2·19	¼										
4128·211	+17·60	½												
3933·825	+ 9·97	½	−19·71	¼										
Weighted Mean	+14·90		− 8·50											
V_a	−22·46		−23·26											
V_d	− ·22		− ·30											
Curv.	− ·28		− ·28											
Radial Velocity	− 8·1		−32·3											

*Check measurement.
P—Primary.
S—Secondary.

SUMMARY OF MEASURES

Plate.	Julian Date.	Phase from final T.	Velocity.	No. of Lines.	Weight.	O–C
1340	2,417,993·802	2·701	−12·1	6	5	+ 5·1
1386	8,010·713	3·772	−24·1	4	6	+ 0·9
1489	047·695	9·074	−43·5	4	4	−12·1
1499	049·605	10·979	− 6·0	1	2	+18·3
1537	080·661	10·360	−19·2	1	2	+ 8·0
1579	098·656	12·515	−27·5	6	3	−13·2
1637	119·621	1·799	−22·3	2	2	−14·3
2021	285·941	9·720	−38·3	2	2	− 8·8
2037	292·938	0·877	− 2·7	4	4	− 4·2
2063	297·934	5·873	−29·3	6	6	+ 3·4
2099	313·897	5·996	−26·9	5	5	+ 5·9
2232	341·807	2·226	−12·7	6	7	0·0
2259	346·795	7·214	−22·9	2	2	+10·9
2299	360·757	5·136	−26·0	6	4	+ 5·6
2321	369·750	14·329	+ 0·7	5	4	− 0·4
2340	374·741	3·479	−31·7	2	2	− 8·3
2354	378·681	7·420	−34·5	4	4	− 0·8
2369	379·694	8·433	−30·4	4	6	+ 2·4
2411	388·699	1·598	−13·8	2	4	− 8·2
2431	389·719	2·618	− 6·4	3	3	+ 9·6
2447	397·671	10·570	−17·5	2	5	+ 8·7
2466	398·786	11·685	−21·5	2	4	− 1·0
2480	405·625	2·679	−20·7	5	6	− 3·6
2494	413·633	10·692	−32·4	2	2	− 6·8
2500	416·510	13·569	+ 2·3	2	4	+ 7·8
2508	420·443	1·662	− 6·4	3	3	− 0·6
2520	423·682	4·901	−34·1	4	6	− 3·6
2525	425·621	6·840	−48·5	2	2	−14·3
2535	430·577	11·796	− 6·9	2	3	+12·8
2549	451·640	1·179	+ 0·2	3	6	+ 1·0
2551	453·688	3·227	− 5·1	2	2	+16·0
2552	458·692	8·231	−37·9	3	1	− 5·8
2557	460·598	10·137	−39·3	3	2	−11·3
2571	473·667	7·366	−41·7	2	1	− 8·0
2583	482·637	0·496	0·0	2	5	− 4·9
2878	588·906	11·725	−20·0	3	4	+ 0·1
2959	626·899	2·198	−12·5	6	6	+ 0·3
3112	686·822	14·601	0·0	3	6	− 3·3
3144	697·833	9·772	−28·2	6	7	+ 1·2
3161	703·715	15·654	+13·0	4	6	+ 5·5
3198	721·687	1·946	−18·2	2	3	− 8·6
3205	724·702	4·961	−34·2	4	6	− 3·8
3212	726·723	6·982	−42·0	2	2	− 8·3
3248	731·687	11·946	−26·3	4	4	− 8·0
3256	733·688	13·947	− 9·4	2	2	− 7·2
3282	734·807	15·066	− 4·5	5	3	−10·6
3321	742·636	7·055	−25·7	5	4	+ 8·0
3340	749·566	13·985	− 5·3	4	5	− 3·3
3353	747·697	12·116	−12·5	4	5	+ 4·7
3357	754·674	3·253	−25·9	3	3	− 4·2
3364	759·680	8·259	−27·9	3	5	+ 4·9
3375	768·639	1·378	+ 8·4	6	4	+11·2
3377	770·666	3·409	−20·0	5	6	+ 2·9
3388	774·817	7·556	−33·1	5	5	+ 0·2
3391	775·611	8·350	−39·8	3	4	− 7·0
3395	776·646	9·385	−29·6	6	5	− 0·9
3397	782·666	15·405	+ 9·9	6	6	+ 2·5
3406	787·625	4·524	−29·3	5	6	− 0·2
3407	789·627	6·526	−31·5	6	4	+ 2·0
3416	790·594	7·493	−40·8	5	6	− 7·1

SUMMARY OF MEASURES—(*Concluded*).

Plate.	Julian Date.	Phase from final T.	Velocity.	No. of Lines.	Weight.	O–C.
3422	2,418,797·549	14·448	+ 2·8* −145·1	5	6	+ 0·7
3441	803·639	4·698	− 32·7	3	5	− 2·9
3454	811·653	12·712	− 13·0	5	4	0·0
3866	9,018·965	14·104	+ 5·2	6	2	+ 6·0
3893	027·880	7·179	+114·6* − 34·0	3	4	− 0·2
4094	106·826	6·925	+ 83·7* − 36·8	4	3	− 3·1
4182	137·786	6·205	− 31·1	5	5	+ 2·0
4231	148·700	1·279	− 8·1	6	4	− 6·1
4267	153·771	6·350	− 32·3	5	3	+ 0·9

* Double Spectrum.

The phases are computed from the final value of T, and the residuals are scaled from the corrected curve. The plates were grouped into seventeen normal places, according to phase, and each weighted as in table below.

NORMAL PLACES FIRST SOLUTION

No.	Julian Date.	Phase.	Velocity.	Weight.	Residuals O−C.
1	2,418,393·130	1·210	+ 1·50	1·0	+4·53
2	742·924	1·733	− 1·75	2·0	−4·49
3	743·191	2·793	+11·44	1·0	+1·68
4	419·903	4·224	− 2·87	2·0	−3·96
5	448·513	5·567	−13·22	2·5	+1·86
6	754·423	6·105	−21·02	1·0	−1·74
7	020·966	6·155	−19·24	1·5	+1·30
8	770·127	7·831	−32·05	2·0	−2·19
9	349·629	8·623	−29·49	2·0	+2·68
10	771·435	10·293	−34·45	2·0	−0·45
11	391·880	10·847	−33·95	1·5	−0·13
12	746·138	12·149	−30·70	2·0	+1·52
13	058·684	12·600	−35·40	·5	−4·17
14	391·700	13·459	−27·95	1·0	+0·68
15	079·036	15·040	−18·90	·5	+2·82
16	476·591	14·834	−16·97	1·0	+4·75
17	762·449	15·349	−16·90	1·5	+2·23

A velocity curve was drawn through the normal places by the graphical method of Dr. King, giving the following preliminary elements:—

$$
\begin{aligned}
P &= 15.84 \text{ days.} \\
e &= .30 \\
\omega &= 10^\circ \\
K &= 22 \text{ km.} \\
\gamma &= -\ 18.50 \text{ km.} \\
T &= 2{,}417{,}991.168\ J.D.
\end{aligned}
$$

A least-squares solution with these elements gave the following corrections:—

$$\begin{aligned}\delta P &= + \quad .00008 \text{ days.}\\ \delta\gamma &= + \ 0.17 \text{ km.}\\ \delta K &= - \ 2.03 \text{ km.}\\ \delta e &= - \quad .060\\ \delta\omega &= +4^\circ.13\\ \delta T &= + \ 0.018 \text{ days.}\end{aligned}$$

The value of Σpvv was reduced from 193 to 137. On substitution in the observation equations it was found that the computed and ephemeris residuals did not agree closely. A second solution was accordingly made. The velocities of six additional plates were included which had been obtained after the first solution was made. The number of normal places was reduced to ten and the period taken as fixed at 15.8401 days. The normal places for the second solution follow. In the last column will be found the residuals from the final curve.

No.	Julian Date.	Phase.	Velocity.	Weight.	Residual.
1	2,418,682·660	1·541	− 0·44	3	−1·0
2	743·191	2·791	+11·45	1	+3·9
3	568·528	4·280	− 2·76	3	−1·8
4	379·090	5·464	−14·59	3	−0·8
5	450·809	6·616	−24·09	2	−0·2
6	537·746	8·269	−30·62	4	+0·4
7	740·258	10·118	−34·32	4·5	−0·5
8	574·889	12·012	−32·45	3	−0·6
9	343·848	13·460	−26·61	1	+0·5
10	536·191	15·092	−17·25	3	+1·1

The solution of these gave as further corrections:—

$$\begin{aligned}\delta\gamma &= + \quad .51 \text{ km.}\\ \delta K &= + \quad .39 \text{ km.}\\ \delta e &= + \quad .024\\ \delta\omega &= -2^\circ.177\\ \delta T &= - \quad .085 \text{ days.}\end{aligned}$$

The definitive elements of the orbit now were:—

$$\begin{aligned}P &= 15.8401 \text{ days.}\\ e &= \ .264\\ \omega &= 11^\circ.95\\ K &= 20.64 \text{ km.}\\ \gamma &= -18.45\\ T &= 2{,}417{,}991.101 \ J.D.\end{aligned}$$

The value of Σpvv was reduced from 43 to 33, and the agreement between the computed and ephemeris residuals was now satisfactory, the greatest difference being .08 km. The table below gives a summary of the values of the elements after each solution.

Element.	Preliminary Values.	First corrected Values.	Final Values.
P	15·84 days.	15·8401 days.	15·8401 days.
e	·30	·24	·264 ± ·024
ω	10°	14°·13	11°·95 ± 5°·57
K	22 km.	20·25 km.	20·64 ± 0 ·40
γ	−18·50 km.	−18·96 km.	−18·45 ± 0 ·32
T	2,417,991·168 J.D.	2,417,991·186 J.D.	2,417,991·101 J.D. ± ·208
$a \sin i$	....	....	4,336,000 km.

In the column of final values is also given the probable error for each element. The probable error of a normal place of unit weight was ± 1.7 km., and that of a plate of average weight was computed from the residuals scaled from the final curve and found to be ± 4.1 km.

Although there are only three measures of the secondary component, an approximation to the value of K was arrived at by substitution in the equation:—

$$\frac{dz}{dt} = \gamma + K\,(\cos u + e \cos \omega)$$

giving the velocity at any point in the orbit. The values of e, ω and γ being known, that of u was determined in the usual way from the mean anomalies at the observed velocities. Successive trials of the values of K in the above equation gave 120 km. as the most satisfactory. Hence a comparison of the masses of the system may be had from the relation:—

$$M_1 : M_2 = K_2 : K_1 = 120 : 20.6 = 5.8 : 1.$$

It is interesting to note that if further measures of the secondary component substantiate this value of K, this proportion of the masses is one of the highest yet obtained. It is probably due to the resulting faintness of the companion that more plates showing the double spectrum were not obtained.

ζ Aquilae.

This star ($\alpha = 19^h\ 1^m$, $\delta = +13°\ 43'$; mag. 3.3) was first observed here in May, 1907. Five plates were taken in that year and in the following year seven more were obtained. It was one of those which were placed on the observing list to measure for variable velocity. The star is of A-type according to Harvard classification, and the lines measured are those of hydrogen H_β, H_γ, and H_δ. These are broader again than in the spectrum of ν Cygni. No other lines were measurable on the plates obtained. A summary of the measures follows. There is a range of 60 km. in the resulting velocities, but as an equal range occurs in the measures of several of the individual plates not much confidence can be placed in them. In one of the plates (1821) there were indications of the lines being doubled, and these were measured and "checked." As will be seen from the summary, the measures of the stronger component in H_γ and H_δ agree fairly well while that of H_β differs widely. The agreement in the secondary is not good. It is probable that the star is a spectroscopic binary, and that the width and diffuseness of the lines is due to the blending of the two spectra. As the accuracy of the measures was a good deal in doubt, further work on this star for the present was discontinued.

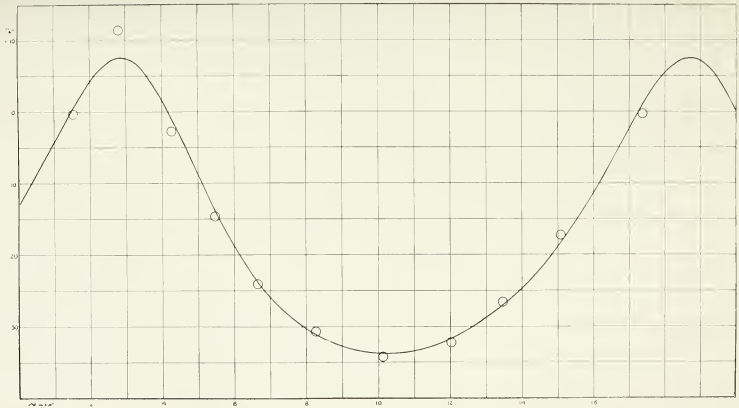


FIG. 9.—Velocity Curve of ω Ursæ Majoris.

RECORD OF SPECTROGRAMS

P—Plaskett.
H—Harper.
P[1]—Parker.
C—Cannon.
T—Tribble.

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure. G.M.T.	Duration.	Hour Angle at End.	Temperature Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1907	h m	m	h m								
ζ Aquilæ....	805	I L	Seed 27	May 31	19 57	15	30 W	11·5	11·0	18·8	18·75	·001	Good.......	P	
" ..	852	"	"	June 14	18 25	20	00	19·8	20·3	23·0	23·0	·0012	"	P	
" ..	864	"	"	" 20	18 15	22	15 W	20·0	19·5	25·4	25·4	·0013	"	H	
" ..	947	"	"	July 16	17 37	26	1 20 W	23·0	......	26·6	....	·0014	....	T	
" ..	1039	"	"	Sept. 12	16 06	39	3 45 W	15·6	15·6	20·9	20·9	·0012	Fair........	T	
				1908											
" ..	1644	"	"	June 26	20 22	35	3 00 W	17·3	17·0	30·0	30·0	·0016	Good.......	P[1]	
" ..	1680	"	"	July 8	19 47	25	3 03 W	17·0	15·5	21·6	21·6	·0015	"	H	
" ..	1778	"	"	Aug. 7	18 40	46	4 00 W	18·8	18·6	23·4	23·4	·0015	Fair........	C	
" ..	1802	"	"	" 20	17 17	34	3 26 W	16·5	16·0	22·2	22·2	·0015	....	H	
" ..	1821	"	"	" 24	15 53	30	2 16 W	16·0	15·2	23·1	23·0	"	Good.......	H	
" ..	1856	"	"	" 31	16 13	34	3 05 W	21·5	21·5	27·7	27·7	"	Fair........	H	
" ..	1887	"	"	Sept. 14	15 45	80	3 55 W	15·5	14·6	21·5	21·3	"	Bad........	P	

MEASURES OF ζ AQUILAE

λ	805.		852.		864.		947.		1039.		1644.		1680.	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861·527......	−52·38	1	−35·55	1	−60·36	½	−26·41	1½	+ 9·87	1	−13·50	½	−19·73	½
4340·634......	−29·55	½	−33·09	1	−41·34	1	−34·56	½	−37·06	½	−24·53	¾	−99·18	¾
4101·890......	−41·32	¼	−82·81	½	−58·42	¼	...	...	+ 4·25	1½	−37·58	¼	−74·65	¼
Weighted Mean.......	−44·27		−44·02		−49·21		−28·45		− 0·76		−23·03		−68·61	
V_a	+15·01		+10·29		+ 8·08		− 2·14		−21·00		+ 5·46		+ 0·72	
V_d	− ·03		·00		·00		− ·09		− ·25		− ·17		− ·22	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity...	−29·6		−34·0		−41·4		−31·0		−22·3		−18·0		−68·4	

MEASURES OF ζ AQUILAE—(*Continued*).

λ	1680.*		1778.		1802.		1821.		1856.		1887.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527.......	−15·96	½	+ 1·01	¾	−33·22	½	−31·19	½	+22·92	½	+15·23	½
4340·634.......	−41·50	½	......	..	−14·61	½	+ 3·86	½	−28·60	¼	− 5·63	½
4101·890.......	−54·51	½	−68·48	1	+16·23	½	+33·50	½	+24·21	½	+33·50	½
Weighted Mean.......	−37·32		−38·70		−10·53		+ 2·05		+13·12		+14·36	
V_a	+ 0·72		−10·87		−15·25		−16·48		−18·38		−22·12	
V_d	− ·22		− ·25		− ·22		− ·15		− ·22		− ·22	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity........	−37·1		−50·1		−26·5		−14·8		−16·3		− 8·2	

* Check measurement.

MEASURES OF ζ AQUILAE—(*Concluded*).

λ	1821*P		1821*S		1821*P		1821*S					
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt
4861·527	+44·69	$\frac{1}{8}$	−197·19	$\frac{1}{8}$	+46·87	$\frac{1}{4}$	−180·79	$\frac{1}{16}$	......	...	......	...
4340·634	+122·04	$\frac{1}{2}$	−30·69	$\frac{1}{4}$	+127·58	$\frac{1}{4}$	−34·56	$\frac{1}{8}$	......	...	......	...
4101·890	+139·75	$\frac{1}{4}$	+31·33	$\frac{1}{8}$	+139·75	$\frac{1}{8}$	+25·09	$\frac{1}{8}$	......	...	......	...
Weighted Mean	+127·90		−10·02		+133·25		−4·74		......		......	
H_γ and H_δ V_a	−16·48		−16·48		−16·48		−16·48		......		......	
V_d	−·15		−·15		−·15		−·15		......		......	
Curv.	−·28		−·28		−·28		−·28		......		......	
Radial Velocity	+111·0		−26·9		+116·3		−21·7		......		......	

ν Cygni.

The star ν Cygni ($\alpha = 20^h\ 53^m$, $\delta = +40°\ 47'$, phot. mag. 4.2), was placed on the observing list here in July, 1907. Only one plate was taken in that year. Six more were obtained in July, August, and September of the following year for the purpose of discovering whether the star was of variable velocity. The star is of A type, the lines measured — H_β, H_γ, H_δ, and *Mg.* λ 4481. The lines measured, and those of hydrogen in particular, are too broad and diffuse for accurate measurement. Appended are the data of the observations and a summary of the measures. As will be seen from the latter it is probable that ν Cygni is of variable velocity though it is felt that the results cannot be greatly depended upon. On this account the star was dropped from our observing list for the present.

* Check measurement.
P—Primary.
S—Secondary.

P—Plaskett.
H—Harper.
P[1]—Parker.
C—Cannon.

RECORD OF SPECTROGRAMS

Star.	No. of Neg.	Camera.	Plate.	Date.	Middle of Exposure. G.M.T.	Duration.	Hour Angle at End.	Temperature Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1907	h m	m	h m								
ν Cygni...	934	I L	Seed 27	July 9	18 52	45	25 W	19·2	19·0	25·2	25·0	·0014	Good.....	H	
				1908											
" ..	1758	"	"	July 31	19 58	40	3 00 W	17·0	16·0	25·3	25·6	·0015	Good......	H	
" ..	1825	"	"	Aug. 24	19 22	45	4 00 W	13·5	13·0	22·7	22·6	·0015	Good.......	P[1]	
" ..	1830	"	"	" 26	19 17	65	4 10 W	14·9	14·2	19·4	19·5	"	Hazy......	P[1]	
" ..	1846	"	"	" 28	16 02	45	55 W	16·1	16·1	23·2	23·2	"	Good.......	C	
" ..	1857	"	"	" 31	17 22	45	2 30 W	21·0	20·8	27·5	27·6	"	Good.......	H	
" ..	1892	"	"	Sept. 16	14 17	85	35 W	18·2	17·6	21·6	21·5	"	Fair.......	P	Smoky.

MEASURES OF ν CYGNI

λ	934.		1758.		1830.		1830.*		1825.		1846.		1857.		1892.	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527...	−78·20	½	−50·63	½	−44·40	½	....	..	−23·65	¼	−37·14	½	−68·19	½	−25·80	½
4481·400...	....	..	....	..	48·91	½	....	..	−20·95	½	....	..	....	..	....	..
4340·634...	64·72	1	−37·27	1	19·52	½	−10·47	½	+11·38	½	−21·92	½	58·46	½	17·43	½
4101·890...	−35·06	½	−43·92	1	−15·53	½	....	..	+10·59	¼	+ 3·47	½	−38·79	½	−25·98	½
Weighted Mean...	−60·67		−42·57		−32·09		−10·47		− 5·36		−18·53		−55·11		−23·06	
V_a	+12·35		+ 7·42		+ ·15		+ ·15		+ ·72		− ·39		− 1·57		− 5·78	
V_d	− ·03		− ·19		− ·19		− ·19		− ·19		− ·03		− ·12		·00	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	−46·6		−35·6		−32·4		−10·8		− 5·1		−19·2		−57·0		−29·1	

* Check measurement.

APPENDIX D.

SOLAR PHYSICS.

RALPH E. DE LURY, M.A., PH.D.

INVESTIGATIONS WITH THE TWENTY-THREE FOOT SOLAR SPECTROGRAPH.

1. *Outline of the Work done with the Spectrograph.*

A brief outline of the work done with the Solar Littrow Spectrograph during the year ending March 31, 1911, will first be given, followed by detailed discussions of several points occurring in connection with the work.

Owing to the poor qualities of the first grating (described in the Report of the Chief Astronomer for 1909, 251-256), a new grating was ordered. This grating, No. 55, was freshly ruled by the Michelson engine at Chicago University and it arrived here on April 15, 1910. Work with the Solar Spectrograph was immediately resumed, Mr. Plaskett joining me in it.

Visual measurements of the focal curves for the different orders from both sides of the grating were made to see if the irregularities which occurred in the case of the first grating were present. The focal curves were practically symmetrically arranged about the normal, little change in focus for a given wave-length being noticed in the different orders. Later photographic measures for certain wave-lengths showed discrepancies in the focal-lengths for different orders caused, possibly, by errors in the spacing of the lines, and the deviations from the visual measures are probably due to the fact that the photographic determinations were made using just that part of the grating which gave no astigmatism. The visual measurements are given below along with those of the first grating, and a discussion of the probable causes of the irregularities of the latter.

Grating No. 55 possesses considerable astigmatism, but I noticed that when the upper half was alone illuminated the astigmatism disappeared. The greater part of this astigmatism is due to the bottom 2 cm. of the ruled surface. By masking 4 cm. the astigmatism is nearly eliminated, while cutting off 5 cm. removes it entirely. By masking 5 cm. off one side of the grating, the definition of the spectrum lines produced is greatly improved. The grating which has a ruled surface 11 cm. × 13 cm. with nearly 700 rulings to 1 mm., is thus masked down to an area 6 cm. × 8 cm. in one corner, to give a spectrum of the best definition and one free from astigmatism. Thus masked, the grating is so brilliant that it is possible to photograph spectra of the rotation effect in 30 seconds, which with the first grating required 10 or 12 minutes to obtain; the definition is also much better with the new instrument. As a result the efficiency of the spectrograph is indefinitely increased, and the purchase of the new grating is entirely justified.

During April, May and June the grating was thoroughly tested and numerous photographs were taken. The second and third orders from one side and the first order from the other side were found to be particularly bright. The tests were made chiefly about the region λ 4500 in the second and third orders—a suitable wave-length at dispersions sufficient for work on the Solar Rotation. These test photographs number from *L*420 to *L*475. From the middle of June to near the

end of July, spectra of the rotation effect at λ 4500 in the second and third orders from one side of the grating were photographed (Plates *L*476 to *L*578). These plates were in the nature of trials, and were made in the face of certain difficulties which I had experienced when taking similar plates with the first grating. The chief of these was the adjustment of the prisms to give the best illumination of the grating. I had constructed a temporary adjustment consisting of adjusting screws working in the thin brass envelopes of the prisms which rested on thin strips of paper about which they could be tilted. This served the purpose only fairly well, and I recommended the construction of a more perfect apparatus working on the same or on the ball and socket principle. The above series of plates impressed on us the necessity of attending carefully to this important point, as well as to having a more accurately adjusted and convenient guide-plate for the sun's image. A more detailed description of these rotation plates will be given below along with measurements of some of them.

During the few satisfactory days in the autumn, plates of the rotation were taken in the regions λ 4250 and λ 5600 in accordance with the recommendations of the Union for Co-operation in Solar Research. Improvements were made in the spectrograph along the lines mentioned above. A new guide-plate was made and better prism adjustments were fitted to the slit-attachment. Mr. Plaskett devised a notched prism to replace the two prisms formerly used above the slit to reflect beams from one limb on both sides of the beam from the other limb. This device simplified greatly the adjusting of the prisms. The scale for reading the angles of inclination of the grating was moved to the top of the spectrograph where they could be more conveniently read, the vernier-pointer being fastened to an arm screwed to the back of the grating-mounting. This arm is bent up behind the grating and continues out through the spectrograph in the axis of rotation of the grating. This necessitated a hole in the box just above the face of the grating. This hole admitted cold air currents to flow over the face of the grating and the definition of the spectrum was injured, as described below. To remedy this the holes were plugged with cotton waste and the end of the spectrograph was boxed in and lined with felt throughout. Truss rods were added to make the spectrograph more rigid. The spectrograph as it now appears is represented in section in Figure 10, the lettering being the same as used in the description given in the Report of 1909, *e.g.*, *S*, slit; *L*, lens; *G*, grating; *C*, photographic plate-holder; *V*, vernier-pointer; and *E*, the scale used with it to read the angles of inclination of the grating, etc.; the double-door, *D'*, and the felt and truss rods recently added are also shown. During the course of the work another difficulty presented itself, namely, the atmospheric distortion and dispersion of the solar image during the winter months when the declination is low. Measurements of this effect made on one occasion are given below.

On December 13, 1910, arrived the Michelson grating No. 43, (7 cm. × 16 cm. surface ruled 680 lines to 1 mm.) made famous by its excellent performance in the fourth order in the work on the satellites of certain mercury lines,(Henry G. Gale and Harvey B. Lemon, Astrophysical Journal, 31, 78-87). This grating was tested and carefully compared with grating No. 55 from the point of view of its applicability to the rotation problem.

Grating No. 43 appeared by direct reflection from one side to have two areas, two-fifths and three-fifths of the grating respectively, of different character, one of these areas giving a red the other a blue reflection, pointing to some difference in the rulings. When viewed from the other side, however, the grating appeared to be of uniform character, and the spectra taken from this side were brighter and sharper than those taken from the other side, the fourth order being particularly brilliant.

The second and third orders were not so bright or so sharp as those from one side of grating No. 55, and consequently the latter was chosen as the better grating for investigating the solar rotation, though undoubtedly grating 43 is an excellent instrument for examining spectrum detail such as the investigation of the mercury lines mentioned above. With some regret this grating was returned. Work with grating 55 on the sun's rotation and related problems was carried on through the rest of the winter.

During the year I endeavoured to determine three known or suspected sources of error in connection with the investigation of the solar rotation, namely, Sky Spectrum, Personal Errors in Measuring the Displacements of Spectral Lines, and Convection in the Sun's Atmosphere. These subjects are interesting and important in themselves, but in studying the sun's rotation they demand particular attention and should be worked out simultaneously with it. I devised methods for studying these subjects and they with other points will be discussed in detail in what follows.

2. *Changes in Focus Produced by Plane Gratings.*

Under the above heading I published a paper in the Journal of the Royal Astronomical Society of Canada, V, 26-32, discussing the changes in focus of the first grating, the measurements of which are given in the Report for 1909. In that paper, grating (*a*) and grating (*b*) refer respectively to the first grating and No. 55 mentioned in the outline above. Subsequent photographic determinations of the foci for λ 4250 and λ 5600 in the second and third orders from the brighter side of grating 55 with all masked but the 6 cm. $\times$ 8 cm. surface described in the outline above, showed differences greater than obtained visually from the whole grating, but the arrangement seems to be, as in the case of the visual measures, symmetrical about the normal, and is likely due to periodic errors in the spacing of the lines. What follows is quoted from the above paper:

"Two-plane gratings of speculum metal have been tested in the Littrow Spectrograph of the Observatory. One of these, grating (*a*), having a 10 cm. $\times$ 12 cm. ruled surface and about 500 rulings to 1 mm., exhibited peculiarities in its focal properties, produced poor spectra and lacked brilliancy to a decided degree; the definition of spectral lines produced by it was greatly improved by masking 2.5 cm. or more off each end of the rulings and 6 or 7 cm. off one side of the grating where it was seen by direct reflection to be of different character from the rest of the grating. It was finally returned to the makers and one of their latest products, grating (*b*), having a 11 cm. $\times$ 13 cm. ruled surface and about 700 rulings to 1 mm., was obtained. This grating showed nearly normal properties and proved to be much more brilliant than the first grating; and when 5 cm. off one end of the rulings and about the same off one side of the grating were masked, the definition of the spectral lines became excellent. The peculiar changes in focus found in the case of the first grating do not in themselves lessen its value, but they are probably intimately connected with its defects and may possibly serve to indicate their cause.

"The optical part of the spectrograph (see, Report of the Chief Astronomer for the year ending March 31, 1909, p. 251) consists of a slit, a 15 cm. (6 in.) lens placed at its focal length (nearly 7 m., or 23 ft.) from the slit, and a grating mounted about 18 cm. back of the lens in its mean position, with its rulings parallel to the slit. Light is directed through the slit so as to nearly fill the lens, which when placed its focal length from the slit, for the wave-lengths under consideration, throws a parallel beam on the grating. The grating diffracts the light back through the lens which focusses the spectrum at the slit. By tilting the grating forward

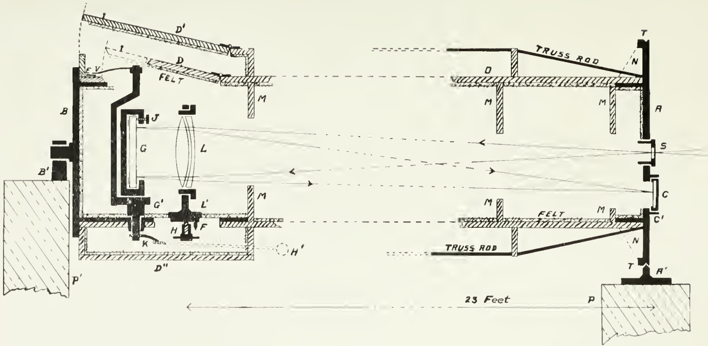


Fig. 10.—The Solar Spectrograph.

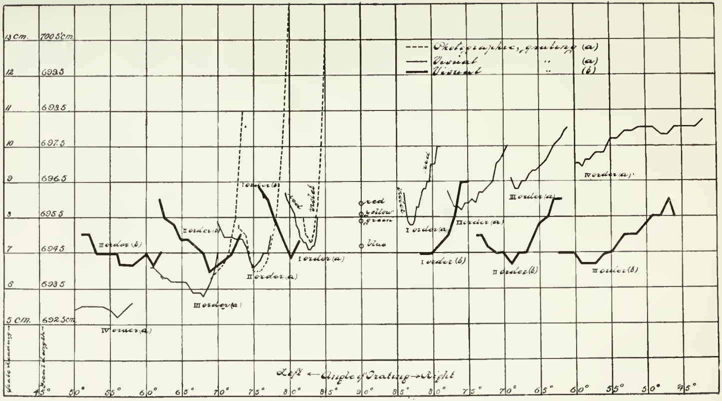


FIG. 11.—Focal Curves from two Plane Gratings in the Solar Spectrograph.

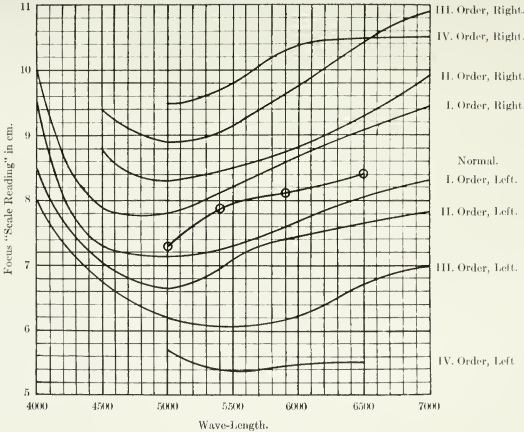


FIG. 12.—Focal Irregularities due to a Plane Grating.

slightly, the spectrum is focussed a little below the slit where it may be conveniently photographed or examined with the aid of an eye-piece. To avoid light reflected from the surfaces of the lens, it is necessary to mask a strip across the middle of the lens, or better, to tilt the lens slightly, as suggested by Mr. R. M. Stewart. The former method was employed in the measurements recorded below, but the latter arrangement has since been adopted: in either case the axis of the lens passed through a point midway, or a little below midway, between the slit and the place where the spectrum was focussed. However, since the distance between the slit and the point where the spectrum was focussed is only 10 cm., it may be assumed for the purposes of this note that the slit and spectrum are coincident on the principal axis of the lens.

"If the grating be placed normal to the beam of light it will act as a plane mirror and reflect back the light through the lens which will focus the light of different wave-lengths at various distances from the slit. By sliding the lens back and forth the different colored images of the slit may be focussed in turn at the slit, employing suitable filters to cut off the light of other colors. This has been done for the colors admitted through the red, green and blue filters of an Ives' tricolor outfit, and a 'Filtergelb' screen; and the distances of the lens from the slit, or the foci, for these colors have been recorded. If the grating be turned about a vertical axis to either the left or the right, the orders will appear in succession from violet to red. The distances of the lens from the slit necessary to focus the light of the different orders at the slit have been determined for the various angles of turning of the grating. All these observations are plotted in Figure 11 for both gratings, (*a*) and (*b*). The measurements were nearly all made visually, and individual observations may be in error from 2 to 6 mm. The measurements for grating (*a*) were made at a temperature of about $20°-21°$ C., while those of grating (*b*) were made at about 18°C. A few observations indicate that a decrease in temperature of 1° C. increases the focus of the lens nearly 1 mm.

"A reference to Figure 11 shows that the focus for any color or wave-length varies progressively from order to order of grating (*a*), while it remains nearly constant in the different orders of grating (*b*). This will be more apparent if it is remembered that, $n.\ \lambda = 2.\ \frac{1}{s} \cdot \sin\theta$, for a Littrow spectroscope, n being the order, λ the wave-length in 10^{-10} metres, s the number of rulings to the mm. — 500 and 700 for gratings (*a*) and (*b*) respectively—and θ the angle of inclination of the grating from the normal, *i.e.*, 90° minus the 'angle of grating' given in the Figure.

"The relation between change of focus and wave-length for the different orders of grating (*a*) is more clearly shown in Figure 12, where the wave-lengths and focus 'scale-readings' are the abscissae and ordinates respectively. The 'normal' focal curve is not known accurately since the average wave-length transmitted by the filters employed is not known very closely and the measurements of focus could not be made with great accuracy on account of the diffraction fringes; however, it is safe to assume that it lies nearly as represented in Figure 12, about midway between the focal curves of the two first orders. A close inspection of these curves shows that, within the limits of the errors of measurement, the change in focus is proportional to the wave-length and to the order, being negative when the grating is turned to the left, and positive and of the same magnitude when it is turned to the right. A fairly accurate value of the decrease or increase in focus for any wave-length in any order is found by taking half the difference between the foci for the wave-length in the right and left focal curves of that order. Such differences are given in the following table:

	I, R.—I, L.	II, R.—II, L.	III, R.—III, L.	IV, R.—IV, L.
4500.............	0·6 cm.	1·7 cm.	2·7 cm.	—
5000.............	0·7	1·7	2·7	3·8 cm.
5500.............	0·9	1·4	3·1	4·4
6000.............	1·0	1·4	3·5	4·9
6500.............	1·1	1·7	3·7	5·0
7000.............	1·2	2·1	3·9	—

"From this table a mean value of the change in focus from the normal of $\pm$ n. 0.5 cm. for say λ 5750 may be derived, and for any wave-length, λ, the change in focus,

$$d = \pm n \,.\, 0.5 \frac{\lambda}{5750} . \text{ cm.}$$

Hence, substituting the value for n . λ mentioned above, it follows that,

$$d = \pm \frac{10^7}{500} \cdot \frac{\sin \theta}{5750} \text{ cm.}$$

Thus it appears that the change in focus is proportional to the sine of the angle of inclination of the grating, being negative when the grating is turned to one side and positive when it is turned to the other. This fact is of great importance in deciding on a theory to account for these changes.

"After I made the focal measurements for this grating, two theories to account for the changes in focus suggested themselves; one, to Mr. Plaskett, that the changes in focus were due to curvature of the ruled lines; the other, to me, that it is due to the curvature of the grooves caused by the ruling point pressing over the ridge between the last furrow made and the one being made, thus producing a concave and a convex side to each furrow. If the latter theory were correct, the second grating should show a somewhat similar behaviour to the first; it behaves quite normally, however, and the proportionality of the changes to the sine of the angle of inclination of grating (a) taken along with this fact makes it seem quite probable that the former theory is the correct one. If, then, it be assumed that the changes in focus are caused by curvature of the ruled lines, it is possible to calculate the amount of the curvature from the changes in focus, as follows:

"Let the normal focus of the lens for any wave-length be f cm., (*i.e.*, the lens must be f cm. from the slit in order to focus the light of the particular wave-length at the slit). Let the focus be changed to $f+d$ on account of the curvature of the ruled lines; the light emerging from the lens to the grating will be convergent or divergent as d is positive or negative. Now, in order that the spectrum may be focussed at the slit, the grating must return the light along the same path, *i.e.*, it must act as a convex or a concave mirror depending on whether d is positive or negative respectively. Suppose the grating does this, then its radius of curvature, r, is given by the formula,

$$\frac{1}{f} = \frac{1}{f+d} - \frac{1}{r}, \text{ or, } -\frac{1}{r} = \frac{d}{f^2}$$

r being negative (*i.e.*, as for a convex mirror) when d is positive, and positive (*i.e.*, as for a concave mirror) when d is negative. It is desired to know the curvature

of the lines measured in the plane of the grating, *i.e.*, corresponding to the value of d when $\theta = 90°$, a value, of course, impossible in practice. For this value of θ, $d = \pm \frac{10^7}{500} \cdot \frac{1}{5750}$ cm., or, $\pm$ 3.5 cm., and the normal value of f for λ 5750, is about 695.5 cm. Consequently, r is found to be about 140,000 cm. This would mean, in a ruling 10 cm. long, a departure at the ends from the position of the centre of the ruling of about 0.00008 cm., or about half the distance between two successive lines of the grating. Such a condition would account for all the defects of the grating in question, and possibly irregularities in the form of the grooves would help to account for its exceptional dimness.

"It may here be mentioned that such measurements as recorded above may sometimes serve to point out—to those who have undertaken the extremely difficult task of ruling gratings—slight errors in the ruling mechanism which may be removed."

3. *Plates of the Solar Rotation Effect, with some Measurements of the Rate of Rotation at the Solar Equator.*

During the year, about 130 plates of the solar rotation effect, having from 4 to 6 exposures on each, were made by Mr. Plaskett and myself for the most part working together. These plates may be grouped in several series according to the region in which they were taken. In the summer of 1910 the plates were made in the region λ 4500 in the second and third orders from the brighter side of the grating (No. 55). All these plates were taken with 5 cm. masked off the bottom of the grating to remove astigmatism. In the second order, 17 plates, $L476-L487$ and $L491-L496$, were made with the whole width of the grating, and 66 plates, $L527-L535$ and $L538-L578$, were made with 5 cm. masked off one side of the ruled surface to improve the definition of the spectrum lines. In the third order, the whole width of the grating was used in taking plates, $L488-L510$; various widths in taking plates, $L511-L517$; and the 8 cm. width remaining when the 5 cm. mentioned above was masked off to give the best definition, was used in making plates $L518-L526$, a total of 33 plates being made in the third order. All plates after $L538$ were made with the best 6 cm. $\times$ 8 cm. area of the grating so mounted that it was placed symmetrically opposite the centre of the lens. In making these photographs, great difficulty was experienced in keeping the prisms adjusted so as to properly reflect the beams of light to the grating. The three beams—two from the West and one from the East limb of the Sun—should each evenly illuminate the grating, for otherwise there would be displacements of the spectra in case the photographic plate was slightly out of focus. The prisms were adjusted so that the beams from each limb evenly filled the unmasked rectangle of the grating, but these were usually of uneven intensity and the exposures for the West and East limbs were, on the average, about 20 and 25 seconds respectively. On some of the plates the two strips from the West limb were found to be of uneven intensity which probably points to an uneven illumination of the grating. After taking some of the plates, the illumination was found to have changed as if due to a temperature effect. To remove these difficulties, stronger and more positive adjustments were made and the two prisms above the slit which were used to reflect the two beams from the West limb were replaced by a single prism, notched as suggested by Mr. Plaskett, to receive the prism which reflected the beam from the East limb. A more perfect and convenient guide-plate replaced the old one, and the scale for reading the angles of inclination of the grating was more conveniently placed, as mentioned in the outline given above. A series of plates, $L600-L629$, were then taken in the few available good hours in November and December. This series was made

about the λ 5600 region as recommended by the International Union for Co-operation in Solar Research (see Mr. Plaskett's Report). A few more plates, *L*713 – *L*717, were taken in this region in March 1911, making a total of 30 plates taken at λ 5600. For taking the photographs at this wave-length, the Seed Process plates, which were sufficiently sensitive at λ 4500, were sensitized with erythrosine and ammonia by Mr. Plaskett. The fresh Seed red "0" Process plates gave the best results when thus stained. The plates were taken at latitudes 0°, 15°, 30°, 45°, 60°, 75°, and 90° with some at 80° and 85° in the λ 5600 part of the spectrum. The settings at these angles were made by rotating the spectrograph (as described in the Report for 1909) after having first determined the "East and West" line which makes a known angle with the Sun's equator at any time. Rotating the spectrograph changes the position of the focussed spectrum on the photographic plate, and consequently a table of corrections had to be made so that a series of exposures at different latitudes could be made on the one plate without danger of having them overlap.

The winter proved to be a very unsatisfactory period for taking rotation spectra photographs. The definition of the solar image was usually poor, the coelostat-house is in shadow except in the afternoon when atmospheric distortion and dispersion of the solar image is apt to occur, and convection currents in the spectrograph occurred when the room was cooled suddenly by opening the doors to the coelostat-house, though this difficulty was finally overcome as described below.

During the course of the above work measurements of the equatorial displacements of selected lines were made in the exposures, *L*528*a*, *L*531*a*, *L*531*b*, *L*569*d*, and *L*570*a* at λ 4500, and *L*600*c*, *L*600*d*, *L*601*d*, *L*610*e*, and *L*616*a* at λ 5600. These measurements are given in the Tables below, along with a description of the plates and an explanation of the symbols used. From these Tables it will be seen that the values of the equatorial rate of rotation of the sun as determined from the different exposures in kilometres per second, are, —*L*528*a*, 2.038; *L*531*a*, 2.038; *L*531*b*, 2.148; *L*569*d*, 1.956; *L*570*a*, 1.901; *L*600*c*, 1.962; *L*600*d*, 1.936; *L*601*d*, 2.021; *L*610*e*, 1.993; *L*616*a*, 1.905. The mean of the first five exposures (at λ 4500) is 2.016, and the mean of the last five (at λ 5600) is 1.964; or the mean of the whole ten exposures is 1.990, a value which is about 4 per cent. lower than the ordinarily accepted value, (Adams found 2.074 for 1906–7, and 2.062 for 1908). This difference may point to a change in the rate of rotation of the sun's reversing layer (as Halm has suggested) possibly accompanying the sun-spot cycle of changes, for 1906-7-8 follow the sun-spot maximum and 1910 approaches the minimum. However, it would not be safe to draw this conclusion from so few measures, particularly since they disagree so much among themselves and in such a manner as to suggest the presence of grave errors:—For example, *L*531*a* and *L*531*b*, taken from the same positions on the sun about 1 minute apart, show a difference of 0.110 km. per second. For these same exposures Mr. Plaskett's measurements give for the value of the equatorial rotation, 2.056 and 2.060 km. per second respectively, the difference in our determinations being therefore due to errors of measurement (this subject is discussed below). Furthermore, the deviations of the means for the various lines from the means of all lines in the two series at λ 4500 and λ 5600 are decidedly great in some cases. Though these results seem to agree with the general conclusions of Adams, I prefer to regard them as due to errors of measurement until many more measurements and the simultaneous investigation of these errors are made; and as will be seen from the results of such an investigation given below, it is not safe to draw any such conclusions from our measurements until the systematic errors of measurement are eliminated. The striking case of the *Si* line λ 5690.646 may be noted. As will be seen from the tables for λ 5600, this line gives on the average a value about 0.36 km. per second

lower than the means for the other lines. This may be due to errors of measurement for the continuous spectrum grows suddenly weaker near this line; or it may be caused by the overlapping of an atmospheric line which is not displaced by the sun's rotation, the highest value for this line being on the dense exposure *L*616*a* which was taken two hours nearer noon than the other measured plates were, when consequently the atmospheric line would be weaker and its effect less. One is tempted to explain this great difference to the presence of *Si* some distance outside of the sun, but as I have pointed out such conclusions are not safe until further measurements are made. Besides errors of measurement the following errors may also be present, and all of these must be reckoned with before accurate values of the solar rotation are deducible and any slight changes which may occur in it may be detected:—Errors due to: Convection in the sun's atmosphere; Changes in the illumination of the grating brought about by temperature effects on the prisms or prism-mountings as suggested above; Alterations in the figures of the mirrors due to heating, with consequent changes in focus and definition of the solar image; Overlapping of the spectrum of the sky and possibly too of matter outside of the sun; etc.

As already stated, however, the above plates and the few measures made of representative exposures, have revealed to us the presence of irregularities, and to remove these and to find out their causes a very careful check must be made of all the numerous variables of which we know to affect the result sought.

In the following Record of Observations for the exposures taken at the equator whose measurements are given in the Tables below, the number of the plate is given followed by a letter denoting the exposure on the plate, then follow the date in 1910 and hour G.M.T., the duration of the exposure in seconds—and where the times are different for the two limbs they are given following the letters W and E denoting West and East respectively. The diameter of the sun measured in mm. is then given, followed by the distance apart in mm. of the two regions inside the limbs from which the light is reflected by the two outside prisms to the slit. The diameter of the sun was measured on the guide-plate except for *L*610*e* and *L*616*a* when it was measured at a distance back of the guide-plate equal to the path of light from the windows in the guide-plate through the prisms to the slit, the image being focussed at this point, and the distance apart of the two regions investigated is the distance between the two narrow strips of metal held in front of the windows so as to shut out the light from the slit, with, in the case of *L*610*e* and *L*616*a*, a slight correction necessary to project this distance on the focal plane. After *D*, is given the heliographical latitude of the centre of the sun's disc; and after v^1 the correction in km. per second to be added to convert the synodical velocity to the sidereal. Then follow remarks concerning the definition.

At λ 4500.

*L*528*a*,-July 5,3:38 G.M.T.; W. 20, E. 25;226.0:220.0; *D*, + 3°.4; v^1, 0.134; Fair.
*L*531*a*,-July 5,7:46 G.M.T.; W. 20, E. 25;226.0:220.0; *D*, + 3.4; v^1, 0.134; Fair.
*L*531*b*,-July 5,7:47 G.M.T.; W. 20, E. 25;226.0:220.0; *D*, + 3.4; v^1, 0.134; Fair.
*L*569*d*,-July 16, 5:31 G.M.T.; 20 secs.; 225.5:220.0; *D*, + 4.5; v^1, 0.134; Fair.
*L*570*a*,-July 19, 3:59 G.M.T.; 30 secs.; 226.0:220.0; *D*, + 4.8; v^1, 0.134; Clouds.

At λ 5600

*L*600*c*,-Nov. 9, 8:20 G.M.T.; 30 secs., 233.0:220.1, *D*, + 3°.4, v^1, 0.141; Fair.
*L*600*d*,-Nov. 9, 8:21 G.M.T.; 40 secs., 233.0:220.1, *D*, + 3.4, v^1, 0.141; Fair.
*L*601*d*,-Nov. 9, 8:37 G.M.T.; 25 secs., 233.0:220.1, *D*, + 3.4, v^1, 0.141; Fair.
*L*610*e*,-Dec. 6, 7:57 G.M.T.; 30 secs., 234.5:221.5, *D*, 0.0, v^1, 0.141; Fair.
*L*616*a*,-Dec. 9, 5:45 G.M.T.; 35 secs., 236.0:221.9, *D*, − 0.3, v^1, 0.141; Fair.

In the following Tables, under "Line" are given the wave-lengths λ of the lines measured, followed by the chemical symbol of the element whose vapor produces the absorption line and the intensity of the line all as given in Rowland's Tables of Solar Wave-lengths; under d are given the measured displacements of the lines in ten-thousandths of 1 mm., determined by measuring the plate one way then turning it through 180° and measuring it again and taking the mean of the two measures, each measure being the difference between the mean of 4 settings on the line in the central strip and the mean of 2 settings on the line in each of the two outside strips: thus, d for each line depends on 16 settings; under v are given the velocities equivalent to half of d, the unit being kilometres per second. The mean value of v for each plate is given and below it the value V of the sun's rotation calculated from the following equation:—

$$V = v. \frac{\textit{Diameter of sun's disc}}{\textit{Distance between prisms.}} . \sec. D + v^1,$$

where v^1, as mentioned above, is the correction to be added to get the sidereal rotation.

TABLES OF MEASUREMENTS OF SOLAR ROTATION PLATES

Line.	*L*528*a*.		*L*531*a*.		*L*531*b*.		*L*570*a*.	
	d	*v*	*d*	*v*	*d*	*v*	*d*	*v*
4432·736, *Fe*, 1....	565	1·863	535	1·764	559	1·843	520	1·716
4435·321, *Fe*, 2....	525	1·730	570	1·878	606	1·996	515	1·610
4438·510, *Fe*, 1....	550	1·910	550	1·810	627	2·065	560	1·846
4445·641, *Fe*, 1....	535	1·758	565	1·854	614	2·018	565	1·859
4453·876, *Ti*, 1....	565	1·854	570	1·870	531	1·742	555	1·823
4464·617, *Ti*, 2....	560	1·832	580	1·897	586	1·919	515	1·688
4468·663, *Ti*, 5....	550	1·799	570	1·935	623	2·037	505	1·653
4484·392, *Fe*, 4....	545	1·775	565	1·841	558	1·818	535	1·745
4489·911, *Fe*, 4....	575	1·872	555	1·806	613	2·024	555	1·808
4502·388, *Mn*, 2....	570	1·850	575	1·865	585	1·898	555	1 804
4508·455, *Fe?*, 4....	585	1·897	585	1·897	622	2·017	520	1·687
4512·906, *Ti*, 3....	575	1·862	585	1·894	587	1·901	510	1·653
4518·198, *Ti*, 3....	590	1·908	595	1·924	642	2·088	550	1·783
4523·572, *Mn?*, 1....	600	1·938	590	1·905	620	2·003	540	1·746
4527·101, *Ca?*, 3....	590	1·904	590	1·904	602	1·943	520	1·681
4531·801, *Fe*, 2....	540	1·742	560	1·806	664	2·141	525	1·695
4534·953, *Ti*, 4....	570	1·837	570	1·837	598	1·927	540	1·741
4546·129, *Fe,Cr*, 3....	565	1·816	550	1·768	612	1·967	510	1·641
4548·938, *Ti*, 2....	575	1·847	575	1·847	629	2·021	520	1·656
4554·211s, *Ba*, 8....	600	1·924	580	1·862	623	1·999	530	1·703
4555·162, *Cr*, 2....	570	1·828	600	1·924	611	1·960	495	1·590
4558·827, *Cr?*, 3....	605	1·939	575	1·843	596	1·910	490	1·589
4563·939s, *Ti*, 4....	595	1·905	555	1·777	565	1·809	481	1·537
4571·275s, *Mg*, 5....	575	1·838	575	1·838	571	1·825	536	1·710
4572·156s, *Ti*, 6....	585	1·869	565	1·806	558	2·103	555	1·776
4578·732s, *Ca*, 3....	580	1·851	615	1·962	622	1·984	595	1·900
4590·126s, *Ti*, 3....	570	1·815	565	1·799	589	1·875	545	1·738
4602·183s, *Fe*, 3....	620	1·968	580	1·841	629	2·038	505	1·606
4603·126, *Fe*, 6....	555	1·762	545	1·730	617	1·958	560	1·780
		1·851		1·851		1·959		1·716
		V=2·038		V=2·038		V=2·148		V=1·901

L569d.

Line.			d	v	Line.			d	v
4368·071,	*Fe,*	2....	562	1·881	4512·906,	*Ti,*	3....	573	1·856
4371·442,	*Cr,*	2....	553	1·849	4514·358,	*Fe, Co,*	1....	560	1·809
4374·628,	*Sc, Fe?,*	3....	528	1·764	4518·198,	*Ti,*	3....	578	1·869
4376·107s,	*Fe,*	6....	520	1·736	4533·419,	*Ti,*	4....	618	1·986
4379·396,	*V,*	4....	552	1·841	4534·139,	*Ti, Co,*	6....	546	1·759
4388·057,	*Fe, Co,*	2....	521	1·901	4534·953,	*Ti,*	4....	563	1·813
4388·571,	*Fe,*	3....	541	1·806	4546·129,	*Fe, Cr,*	3....	594	1·844
4389·413,	*Fe,–,*	2....	544	1·811	4548·024,	*Fe,*	3....	585	1·876
4394·225,	*Ti?,*	2....	515	1·713	4548·938,	*Ti,*	2....	574	1·840
4395·201,	*Ti,*	3....	541	1·799	4554·211s,	*Ba,*	8....	612	1·964
4398·178,	*Zr?,*	1....	510	1·695	4555·662,	*Ti,*	3....	517	1·659
4399·935,	*Ti, Cr,*	3....	533	1·770	4556·063,	*Fe,*	3....	609	1·952
4400·555,	*Sc,*	3....	536	1·780	4456·306,	*Fe, Cr,*	4....	631	2·024
4401·709,	*Ni,*	2....	499	1·657	4560·266,	*Fe,*	2....	495	1·587
4415·722,	–,	3....	515	1·704	4563·939s,	*Ti,*	4....	555	1·777
4417·884,	*Ti,–,*	3....	536	1·773	4571·275s,	*Mg,*	5....	577	1·844
4422·741,	*Fe, Y,*	3....	565	1·866	4572·156s,	*Ti,–,*	6....	571	1·825
4425·608s,	*Ca,*	4....	533	1·759	4574·899,	*Fe,*	2....	591	1·882
4430·356,	*Fe,*	1....	563	1·868	4578·732s,	*Ca,*	3....	546	1·742
4430·785,	*Fe,*	3....	568	1·873	4590·126s,	—,	3....	587	1·869
4433·390,	*Fe,*	3....	537	1·770	4600·932,	*Cr,*	3....	540	1·716
4435·851s,	*Ca,*	4....	538	1·773	4602·183s,	*Fe,*	3....	529	1·679
4437·112,	*Fe, Ni,*	2d?..	492	1·621	4603·126,	*Fe,*	6....	526	1·670
4443·465,	*Fe,*	3....	586	1·927	4616·305,	*Cr,*	4....	595	1·884
4443·976,	*Ti,*	5....	488	1·603	4625·227,	*Fe,*	5....	569	1·797
4447·302,	*Mn, Fe,*	2....	537	1·764	4626·358,	*Cr,*	5....	565	1·784
4450·654,	*Ti?,*	2....	542	1·780	4629·521s,	*Ti, Co,*	6....	481	1·518
4454·552,	*Fe,*	3....	522	1·713	4630·306,	*Fe,*	4....	530	1·672
4461·818,	*Fe,*	4....	543	1·778	4636·027,	*Fe,*	2....	595	1·875
4468·663,	*Ti,–,*	5....	520	1·701	4637·685s,	*Fe,*	5....	566	1·783
4484·392,	*Fe,*	4....	561	1·825	4638·193s,	*Fe,*	4....	613	1·932
4485·846,	*Fe,*	3....	460	1·498	4643·645s,	*Fe,*	4....	598	1·882
4489·911,	*Fe,*	4....	547	1·780	4646·347,	*Cr,*	5....	514	1·616
4501·448s,	*Ti,–,*	5....	575	1·866	4651·461,	*Cr,*	4....	579	1·819
4508·455s,	*Fe?,–,*	4....	471	1·527	4652·343,	*Cr,*	5....	627	1·976

1·774

$V = 1·958$

Line			L600c.		L600d.		L601d.		L610e.		L616a.	
			d	v	d	v	d	v	d	v	d	v
5506·095,	*Mn*,	1......	677	1·753	664	1·719	734	1·900	671	1·737	536	(1·388)
5507·000,	*Fe*,	7......	675	1·747	661	1·711	665	1·720	679	1·757	607	1·571
5525·765,	*Fe*,	4......	684	1·762	558	1·438	697	1·811	621	1·600	660	1·700
5528·641,	*Mg*,	8......	658	1·695	670	1·723	719	1·852	730	1·879	662	1·704
5544·157,	*Fe*,	2......	....	......	....	......	....	......	745	1·911	645	1·654
5562·933,	*Fe*,	2......	....	......	....	......	....	......	680	1·736	620	1·583
5576·320,	*Fe*,	4......	650	1·653	671	1·709	707	1·797	672	1·710	616	1·568
5578·946,	*Ni*,	1......	711	1·810	693	1·763	687	1·747	671	1·707	642	1·633
5582·198,	*Ca*,	4......	711	1·807	680	1·728	698	1·774	694	1·764	712	1·809
5590·343,	*Ca*,	3......	675	1·712	605	1·533	693	1·758	708	1·796	685	1·737
5598·524,	*Fe*,	1......	661	1·673	639	1·617	656	1·662	....	......	....	......
5618·858,	*Fe*,	1......	....	......	....	......	....	......	686	1·728	727	1·831
5634·171,	*Fe*,	3......	....	......	....	......	....	......	670	1·681	616	1·546
5638·488,	*Fe*,	3......	715	1·792	747	1·871	783	1·964	751	1·882	658	1·649
5655·715,	*Fe*,	2......	699	1·744	712	1·778	773	1·929	654	1·632	634	1·582
5658·097,	*Y*,	2......	647	1·612	712	1·775	680	1·694	739	1·843	647	1·613
5662·744,	*Fe*,	4......	653	1·627	695	1·731	728	1·815	669	1·667	660	1·644
5675·647,	*Ti*,	2......	685	1·702	582	1·444	658	1·633	....	......	....	......
5682·869,	*Na*,	5......	667	1·653	738	1·831	687	1·704	694	1·720	734	1·820
5688·436,	*Na*,	6......	708	1·753	696	1·723	657	1·625	....	......	....	......
5690·646,	*Si*,	3......	518	(1·282)	561	(1·388)	559	(1·384)	490	(1·213)	614	(1·519)
				1·718		1·694		1·774		1·750		1·659
			V = 1·962		V = 1·936		V = 2·021		V = 1·993		V = 1·905	

4. *Errors in the Measurement of Spectral Line Displacements.*

The presence of systematic errors of a personal nature in the measurements of the positions of spectrum lines has often been suspected, yet little attempt has been made to determine their character and magnitude. In the present report a method for investigating and eliminating these errors is described along with some measurements made in connection with the problem of the solar rotation, after first briefly mentioning some of the more important questions likely to be affected by such errors.

Systematic personal errors are suspected to occur in the measurements of the following investigations:

(*a*) *The Determination of Wave-lengths.* The greater part of this work involves repeated "settings," on the lines whose wave-lengths are sought and on other lines called "standards" whose wave-lengths are known. These "settings" consist in turnings of a micrometer-screw carrying the measuring microscope or the photograph of the spectrum, until the line or lines of the microscope are placed as closely as the measurer can see, over or symmetrically about the centres, centres of intensity or some other selected part of the spectrum lines and recording the corresponding scale-readings. It is obvious that if one observer uses the centre of the line for his settings and another uses the centres of intensity, systematic errors will occur since for some lines the two "centres" coincide while on others they do not. Again,

even if two persons strive to set on the same part of the line such things as unsymmetrical shading of the line, the nearness of other lines, etc., may affect them differently and result in different settings with consequent errors in the determination of the wave-length. Such errors are so small, when the spectrum is on a large scale, that for many purposes the measurements are sufficiently accurate. In the determination of standard wave-lengths, however, an effort should be made to eliminate even these errors. It is generally assumed that the mean of the measurements of several measurers is well within the limits of the accidental errors. This is not necessarily the case, however, for disturbing influences such as those mentioned above may operate on the measurements systematically in the same way for the different persons. There is apparently some evidence of this in the determination by interferometer methods of the "Secondary Standards of Wave-length, International System, in the Arc Spectrum of Iron,"* by Fabry and Buisson, Eversheim and Pfund, as the following quotation from H. Kayser's paper on "Standards of Third Order of Wave-lengths on the International System,"† would seem to show: "I have employed as standards the arithmetical means of the measurements of Fabry and Buisson, Eversheim and Pfund. The portions of spectrum measured were always between three or four successive standards, so that each line is referred to as many neighboring standard lines as possible. It turned out that measurements of the same sharp line on different plates yielded differences of not more than from 0.001 to 0.002 Å, when the same standards were employed; but if different standards were employed, differences as great as about 0.006 occurred. This proves that some of the standards still contain errors of from 0.004 to 0.005 Å, and that measurements of the best plates in the second order give a greater degree of accuracy than that of the secondary standards." I cannot say that I am wholly convinced by the argument. It seems to me quite possible that Kayser's own settings on the secondary standards may contain systematic errors greater than the differences in the "measurements of the same sharp line on different plates." However, the fact remains that in the determinations of either the secondary or the tertiary standards, or both, *there are systematic errors greater than the accidental errors of measurement.*

(*b*) *The determination of Stellar Radial Velocities.* In this work systematic errors of measurement are more likely to occur than in any other involving the measurement of spectra, because the spectra measured—the star spectrum with its usually diffuse absorption lines, and the comparison spectrum with its strong emission lines—are so different in character. Furthermore, since the lines of the star spectrum often differ greatly in appearance and are in regions of the continuous spectrum of different intensity, systematic differences in velocity for the various lines are likely to be found, and since the star spectra are on a very small scale, these may represent variations of several kilometres per second. Such differences have been found, and though there are plausible physical explanations which one can give, such as convection, electrical or magnetic effects, pressure effects, the presence of other bodies or of a hazy envelope about the star having a different motion, etc., yet it would be advisable before employing such theories to eliminate the possibility of systematic errors of measurement.

(*c*) *The comparison of various regions in the Sun with one another and with Standard Spectra.* Much of this work depends on comparative measurements of spectra of different character, and, as pointed out above, is therefore liable to contain systematic error. Among the more important investigations in this field are some of those carried out at Mount Wilson Solar Observatory, on the displace-

* Astrophysical Journal, 32, 215–216.
† Astrophysical Journal, 32, 217–225.

ments of the spectrum lines at the sun's limb,* and the motions of calcium vapor in the solar atmosphere† and over special regions in the sun.§ The accidental errors of measurement in this work are extremely low, a precision of 0.001 Å being aimed at, and such being the case it would be well worth while to test for systematic errors which may well exceed this small quantity. Furthermore, in deciding whether the interesting results observed in these researches are due to pressure or to convection very accurate references to laboratory comparison spectra were necessary, and the spectra compared being widely different the decisions may have been affected by systematic error. Even so may be affected the results derived from the comparison of "enhanced" and "arc" lines in the same spectrum.‡

(*d*) *The determination of the rate of the solar rotation.* The method chiefly used at present in the investigation of the rate of the sun's rotation, is that employed by Adams** at the Mount Wilson Solar Observatory, namely, the measurement of the spectral line displacements in adjacent simultaneously taken photographs of the spectra from opposite ends of a diameter of the sun's disc. These measurements differ from those made in the investigations mentioned above, in that the relative positions are sought of *the same spectral lines in two presumably similar spectra,* and consequently it is not so easily imagined, as in the case where *two different spectra* are compared, how systematic errors of measurement may happen. Nevertheless, it was in connection with this very problem that I first suspected the presence of such errors. In 1909, I measured a few plates of the solar rotation effect which I made with the twenty-three foot Littrow spectrograph, using a plane grating which apparently on account of curvature of the lines†† (as shown previously in this report) produced spectra of very poor definition. The spectrum lines were not sharp and the continuous spectrum was nebulous. From my measurements of from 30 to 80 lines on each of three plates, I noted that the greater proportion of the lines giving the largest values of the measured displacements were the broader and more fuzzy lines or those very close to other lines or to nebulous regions of the spectrum. A few scattered measurements on other plates seemed to confirm this observation. Measurements of one of these plates were published along with a description of the spectrograph§§ simply to illustrate the method, but even from these 80 measurements the tendency for the broader and more diffuse lines to give larger values for the displacement is noticeable. The mean velocity-equivalent of the measured displacements is 1.77 km. per second, and of the 9 lines which yield values greater than 1.90 km. per second, 4 are exceptionally broad or fuzzy lines, 1 is in a nebulous region and another is very close to another spectrum line, as follows: 4163.818, fuzzy, 1.95 km.; 4199.257, fuzzy, 2.13, and 1.95 km.; 4236.279, near 4236.112, 1.92, and 1.94 km.; 4246.966, broad and fuzzy, 1.94 km.; 4271.325, broad and fuzzy, 1.91 km.; (4271.934, broad and fuzzy neighboring line gives a value nearly as great, 1.87 km.); 4288.310, nebulous region, 1.98; the other three lines appear to be average lines. These measurements with the others mentioned above certainly warranted the suspicion that the broader and more nebulous lines gave larger values, and so much was I impressed by them that my suspicions extended to the measurements of Adams on the rotation (loc. cit.) values for the two very broad and shaded lines $H\alpha$ and λ 4227, which he found to give larger values for the rate of the sun's rotation than those obtained from the

* Walter S. Adams, Astrophysical Journal, 31, 30–61.
† Charles E. St. John, Ibid, 32, 36–82.
§ Charles E. St. John, Ibid, 34, 57–78.
‡ Walter S. Adams. Some results of a study of the spectra of Sirius, Procyon and Arcturus with high dispersion, Astrophysical Journal, 33, 64–71.
** Ibid, 26, 203; 29, 110; 27, 213.
†† De Lury, Journal Roy. Astron. Soc. Can., 5, 26–32.
§§ Report for 1909, p. 256.

narrower absorption lines. I felt the necessity of making measurements to test these suspicions, but thought it better to wait until a new grating giving sharper spectrum lines was obtained. Consequently, when work with the new grating was well under way and some measurements were made which still showed systematic tendencies, particularly some comparative measures by different persons, I proposed to make tests for systematic errors of measurements to be carried out in connection with the measurements of the plates of the solar rotation effect, in the hope that I could eliminate these errors if they actually existed, and also that I might throw light on my suspicions as to the reality of the results obtained by Adams regarding the systematically different displacements of various lines. I accordingly devised a method of attacking the problem, a description of which, together with some preliminary measures, constitutes the remainder of this section of the report.

The method consists essentially in introducing on the spectrum lines under investigation by mechanical means an arbitrary displacement—of known magnitude if desired—which is the same for all the lines, and which should yield, in the absence of systematic errors, the same measured values within the limits of the accidental errors, and for a large series of observations the same means for all the lines whether measured by the same or different observers; if the means of the measured values in such a series are not close to the same value, then systematic errors are present, and their magnitude and nature can be determined from the differences.

The arbitrary displacement may be introduced by taking the photograph of one spectrum first, then shifting the plate-holder and taking the photograph of the other spectrum. The plate-holder may be moved between stops or moved by means of a micrometer screw. The method is very satisfactory if one is not anxious

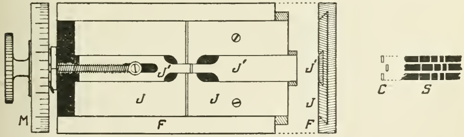


FIG. 13.—Double-Slit Apparatus.

to have the displacements on a series of plates identically the same. For several reasons, however, I desired the latter condition and accordingly devised a second method of obtaining the displacement. This method consists in the taking of spectra from two parallel slits whose widths and distances apart are adjustable and may be kept constant for a series of plates, the distance apart of the slits governing the displacement of the spectra. To reproduce the configuration of the "rotation spectra" taken here, I had the "double-slit" constructed in the form shown in Figure 13, which represents a bird's-eye view of the apparatus. F, is a brass frame with bevelled runs in which the slit-jaws, J, J, work. These jaws are also milled with bevelled runs in which the smaller jaws, J', J', slide. The slit-edges of all these jaws are parallel, and they are bevelled back leaving their sharp edges in the plane of their faces. The smaller jaws were set in the larger and their edges polished simultaneously to insure parallelism, the polishing being done on plate-glass with the finest emery. One of the jaws, J, is screwed to F in a fixed position, while the other may be slid back and forth in F by means of the micrometer, M, with the aid of a coiled spring as in ordinary spectrograph-slits, and the distance between the jaws may be read in ten-thousandths of an inch. The slit between the jaws, J', J',

may be adjusted to any desired distance to either side of the slit between the larger jaws. The widths of the two slits will be the same if they are adjusted so that they close simultaneously, since, when jaw, *J*, is moved by the micrometer it carries with it one of the smaller jaws. A mask is next placed over the slits to give the configuration *C*. The double-slit replaces the ordinary slit of the spectrograph, and the spectra taken are represented by *S*. A precisely similar mask is used in taking the rotation spectra, so that the widths of the strips of spectra and the distances apart are exactly the same. Both spectra are taken from the same distance inside the limb of the sun, so that the only difference between them lies in the fact that in the rotation spectra the displacement of the spectral lines is due to the rotation of the sun, while in the double-slit spectra the displacement is caused by the displacement of the slits and is therefore the same for all lines. Measurements of the latter should therefore reveal the exact nature of the errors of measurement of the former. In a somewhat similar manner the double-slit may be employed to investigate the errors of measurement in connection with the other problems mentioned above. If the double-slit is to be used very much it will be found advantageous to provide a micrometer attachment to the right-hand jaw, *J'*, so that its distance from the slit made by the larger jaws may be readily adjusted. For use in the present investigation the displacement was fixed at about 0.07 mm. the value of the displacement at the equator on the rotation plates at λ 4250, the region chosen because it was that employed by Adams in his work on the Solar Rotation and is the common region selected by the International Union for Co-operation in Solar Research.

In making the measurements the large Toepfer measuring machine of the Observatory was used. This instrument has a thread 30 cm. (12 in.) long and of 0.5 mm. pitch and is capable of measuring over the whole range of the 12 in. plates taken in the solar spectrograph. The micrometer reads to microns and estimations to one-tenth of this value, *i.e.*, to one ten-thousandth of a mm., (0.0001 mm.) may be made. The measures given in the following Tables are expressed in this unit. All measurements of the displacement of any line consist in taking the difference between the means of 4 settings on the line in the central strip of spectrum and the mean of 2 settings on the line in each of the two outside strips; when all the lines in question are measured, the plate is turned through 180° and the measurements repeated, the run of the micrometer screw being in the opposite direction: the mean *d*, of the means *d'* and *d''*, from the two runs for each line is the measured displacement for that line, and it thus depends on 16 settings. Before giving the bulk of the measurements of the arbitrary displacement plates, I will present some results illustrating the differences in the measures of the same lines by different observers. In the Tables, *r* denotes the residual obtained by subtracting the mean value of *d* from the *d* in question.

TABLE I.
Plate, *L570a*, (Rotation Effect).

	4548·938		4558·827		4564·939		4571·275		Means	
	d	*r*	*d*	*r*	*d*	*r*	*d*	*r*	*d*	*r*
Plaskett	533	− 4	537	+14	540	+25	545	+21	539	+14
Harper	563	+26	515	− 8	510	− 5	510	+26	535	+10
Parker	550	+13	540	+17	500	−15	520	− 4	528	+ 3
Cannon	540	+ 3	552	+29	513	− 2	502	−22	527	+ 2
Motherwell	543	+ 6	500	−23	500	−15	522	− 2	516	− 9
De Lury	493	−44	496	−27	526	+11	507	−17	506	−19
	(520	−17)	(490	−33)	(481	−34)	(536	−12)	(507)	.....
Means	537	......	523	......	515	......	524	......	525	......

NOTE.—The bracketed values are duplicate measures previously made and whose peculiar differences made it desirable to have measurements made by other observers. All but the bracketed values are derived from measures made in only one position of the plate.

TABLE II.

*L*701*f*, ARBITRARY DISPLACEMENT BY DOUBLE-SLIT.

	4220·509, Fe, 3			4225·619, Fe, 3			4232·887, Fe, 2			4241·285, Fe–Zr, 2			4246·996, Sc., 5.			Means.		
	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d
Plaskett	721	704	713	720	730	725	700	713	706	707	700	704	689	683	686	707	706	707
	(712	697	709)	(687	710	699)	(702	687	695)	(715	718	716)	(688	690	689)	(701	700	700)
Cannon	706	701	704	679	725	702	678	660	669	710	668	689	687	731	709	692	697	694
Parker	648	716	682	663	744	704	709	671	690	691	725	704	663	688	675	675	709	692
Harper	676	700	688	706	742	724	654	666	660	714	681	697	669	671	670	684	692	688
De Lury	669	682	676	733	701	717	649	659	654	710	702	706	653	690	671	683	687	685
	(669	731	700)	(741	726	734)	(691	638	664)	(648	652	650)	(715	660	688)	(693	681	687)
Stewart	658	687	673	656	712	684	683	649	666	663	669	666	705	658	682	673	675	674
Means d'	680			693			679			699			678			686		
Means d''		698			726			669			689			686			694	
Means d			689			709			674			694			682			690

NOTE.—The bracketed values, previously obtained, suggested the advisability of repeating the measurements and having other observers make them also. The bracketed values are not included in taking the means. The values obtained for the whole exposure *L*701*f* at the previous measurement, were, Plaskett, 702; De Lury, 686.

TABLE III.

*L*641, Arbitrary Displacement by moving the Plate-Holder.

Line,	Width.	Remarks.	*L*641*a*.				*L*641*b*.				*L*641*c*.				*L*641*d*.			
			d'	d''	d	r	d'	d''	d	r	d'	d''	d	r	d'	d''	d	r
1, 5506·095, *Mn*, 1...	1286	Weak..........	1053	906	980	+119	641	665	653	+53	658	771	714	−49	999	1037	1018	− 8
2, 5507·000, *Fe*, 7...	1776	Broad, strong..	861	841	851	− 10	611	644	628	+28	792	729	760	−31	999	1037	1018	− 8
3, 5525·765, *Fe*, 4...	1332	Fine..........	801	851	826	− 35	644	615	630	+30	691	728	709	−54	1005	1106	1055	+29
4, 5528·641, *Mg*, 8...	2816	Shaded, fuzzy..	704	969	837	− 24	627	548	588	−12	839	673	756	− 7	951	998	974	−52
5, 5544·157, *Fe*, 2...	1050	Fine..........	874	844	859	− 2	601	614	608	+ 8	742	678	710	−53	1032	1089	1060	+34
6, 5562·933, *Fe*, 2...	1119	Fine..........	827	853	840	− 21	551	648	600	0	742	757	749	−14	1013	957	985	−41
7, 5576·320, *Fe*, 4...	1688	Strong..........	833	824	829	− 32	587	642	615	+15	783	814	798	+35	969	1033	1001	−25
8, 5578·946, *Ni*, 1...	1142	Fine..........	902	892	897	+ 36	544	601	573	−27	782	729	755	− 8	1060	1042	1051	+25
9, 5582·198, *Ca*, 4...	1410	Strong..........	848	819	833	− 28	602	608	605	+ 5	729	716	722	− 4	1013	977	995	−31
10, 5590·343, *Ca*, 3...	1544	Fine..........	931	938	935	+ 74	563	588	576	−24	741	776	758	− 5	1056	1080	1068	+42
11, 5618·858, *Fe*, 1...	1072	Fine..........	855	875	865	+ 4	585	496	541	−59	787	909	848	+85	1095	1120	1107	+81
12, 5634·171, *Fe*, 3...	1295	....	822	710	766	− 95	596	664	630	+30	779	773	776	+13	959	943	951	−75
13, 5638·488, *Fe*, 3...	1452	....	888	911	900	+ 39	576	607	592	− 8	794	818	806	+43	1012	1008	1010	−16
14, 5655·715, *Fe*, 2...	1300	....	750	905	827	+ 34	580	568	574	−26	857	823	840	+77	1091	998	1044	+18
15, 5658·097, *Y*, 2...	1329	....	655	813	734	−127	611	638	625	+25	822	749	785	+22	982	1028	1005	−21
16, 5662·744, *Fe*, 4...	1343	Weak region..	885	822	852	− 9	592	668	630	+30	744	788	766	+ 3	1046	1103	1074	+48
17, 5682·869, *Na*, 5...	1536	....	971	849	910	+ 49	585	734	660	+60	744	778	761	− 2	988	974	981	−45
18, 5688·436, *Na*, 6...	1808	....	862	822	842	− 19	525	607	566	−34	767	784	775	+12	1027	1099	1063	+37
19, 5690·646, *Si*, 3...	1090	Narrow, weak..	923	1039	981	+120	495	528	512	−88	714	688	701	−62	1030	1012	1021	− 5
		Means d'	855	......	......	......	685	......	......	......	764	......	......	......	1018	......	......	806
		Means d''	......	867	......	......	......	615	......	......	......	762	......	......	......	1034	......	820
		Means d	......	......	861	......	......	......	600	......	......	......	763	......	......	......	1026	813

TABLE IV.

*L*699, ARBITRARY DISPLACEMENT BY DOUBLE-SLIT.

Line.	*L*699*a*.			*L*699*b*.			*L*699*c*.			*L*699*d*.			*L*699*e*.			*L*699*f*.			Means.			
	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d	r
1, 4196·699, *La*, 2..	654	639	647	646	730	688	736	795	764	715	721	718	663	719	691	721	689	708	690	716	703	+10
2, 4197·257, *CN*, 2..	614	655	634	798	797	798	711	704	708	675	719	697	633	780	707	690	674	682	687	721	704	+11
3, 4216·136, *CN*, 2..	723	679	701	678	695	686	727	678	702	641	748	695	713	730	721	743	740	741	704	712	708	+17
4, 4220·509, *Fe*, 3..	626	638	632	724	725	725	710	777	744	729	681	705	705	670	688	654	715	685	691	701	696	+ 4
5, 4225·619, *Fe*, 3..	726	743	735	634	631	632	793	711	752	641	638	639	667	692	679	742	712	727	700	688	694	+ 1
6, 4232·887, *Fe*, 2..	696	668	682	697	687	692	755	731	743	675	675	675	666	689	678	611	660	635	683	685	684	− 9
7, 4241·285, *Fe-Zr*, 2..	711	666	688	671	646	658	611	655	633	685	781	733	720	735	727	850	767	808	708	708	708	+15
8, 4246·996, *Sc*, 5?.	642	637	639	660	628	644	693	727	710	604	747	676	689	729	709	716	792	754	667	710	689	− 4
9, 4257·815, *Mn*, 2..	642	743	693	604	595	599	600	701	650	657	713	685	631	722	677	705	767	736	640	707	673	−20
10, 4258·477, *Fe*, 2..	687	698	692	673	673	673	699	705	702	712	653	683	705	672	688	664	733	698	690	689	689	− 4
11, 4266.081, *Mn*, 2..	641	635	638	696	738	717	626	726	676	722	686	704	682	670	676	656	689	673	671	691	681	−12
12, 4268·915, *Fe*, 2..	590	589	589	719	659	689	690	609	644	708	681	694	650	696	673	704	686	695	677	653	665	−28
13, 4276·836, *Zr*, 2..	713	717	715	660	680	670	610	658	634	724	724	724	698	705	702	710	675	692	686	692	689	− 4
14, 4290·377, *Ti*, 1..	716	771	744	764	747	755	697	719	708	730	663	697	700	682	691	640	715	678	708	716	712	+19
15, 4291·630, *Fe*, 2..	733	761	747	670	657	664	670	663	667	740	683	711	719	692	700	668	709	688	700	692	696	+ 3
Means d'	674	.....	.....	686	.....	.....	689	.....	.....	691	.....	.....	683	.....	.....	699	.....	.....	687	.....	.....	±10·7
Means d''	.....	683	.....	.....	686	.....	.....	704	.....	.....	701	.....	.....	706	.....	.....	715	.....	.....	699	.....	
Means d	.....	.....	678	.....	.....	686	.....	.....	696	.....	.....	696	.....	.....	694	.....	.....	707	.....	.....	693	

TABLE V.

*L*701, ARBITRARY DISPLACEMENT BY DOUBLE-SLIT.

Line.	*L*701*a*.			*L*701*b*.			*L*701*c*.			*L*701*d*.			*L*701*e*.			*L*701*f*.			Means			
	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d	d'	d''	d	r
1, 4196·699, *La*, 2..	641	606	624	673	736	704	663	616	640	700	742	721	675	724	699	678	757	717	671	697	684	−10
2, 4197·257, *CN*, 2..	647	586	616	654	748	701	622	610	616	758	785	772	674	675	675	586	620	603	657	671	664	−30
3, 4216·136, *CN*, 2..	651	740	696	696	675	686	728	713	720	672	692	682	696	732	714	703	726	715	685	719	702	+ 8
4, 4220·509, *Fe*, 3.	762	728	745	748	704	726	707	673	690	642	667	654	687	687	687	669	731	700	702	698	700	+ 6
5, 4225·619, *Fe*, 3..	686	660	673	754	811	782	729	744	737	791	655	723	747	700	723	741	726	733	740	716	728	+34
6, 4232·887, *Fe*, 2..	707	651	679	714	736	725	699	702	700	724	713	719	706	670	688	691	638	665	713	685	699	+ 5
7, 4241·285, *Fe-Zr*, 2..	718	755	736	620	681	651	693	737	715	756	747	751	656	672	664	648	652	650	683	707	695	+ 1
8, 4246·996, *Sc*, 5?.	660	647	654	641	671	656	674	778	726	636	771	704	646	681	664	715	660	687	629	701	665	−29
9, 4257·815, *Mn*, 2..	675	705	690	765	762	763	744	699	722	623	660	641	685	719	702	816	727	772	718	712	715	+21
10, 4258·477, *Fe*, 2..	697	709	703	694	651	673	698	714	706	666	683	675	682	695	688	680	696	688	687	691	689	− 5
11, 4266·081, *Mn*, 2..	673	677	675	618	614	616	753	765	759	701	748	724	695	636	666	641	650	645	680	682	681	−13
12, 4268·915, *Fe*, 2..	655	663	659	665	741	703	636	662	649	682	652	667	700	701	700	633	629	631	661	675	668	−26
13, 4276·836, *Zr*, 2..	746	749	747	697	703	700	737	725	730	709	665	687	668	656	662	667	706	686	703	701	702	+ 8
14, 4290·377, *Ti*, 1..	752	733	743	733	742	737	716	711	714	737	735	735	734	727	730	669	686	678	724	722	723	+29
15, 4291·630, *Fe*, 2..	724	710	717	636	686	661	727	676	701	659	612	636	711	672	692	710	738	724	694	682	688	− 6
Means d'	693	....	....	687	....	....	702	....	....	697	....	....	691	....	....	683	....	....	690	....	....	±15·4
Means d''	....	687	....	....	711	....	....	702	....	....	701	....	....	689	....	....	689	....	....	697	...	
Means d	....	....	690	....	....	699	....	....	702	....	....	699	....	....	690	....	..	686	....	....	694	

TABLE VI.

ERRORS OF SETTING.

*L*699, Arbitrary Displacement by Double-Slit.

Line			Algebraic Means.				Arithmetic Means.				
			1st.	2nd.	3rd.	4th.	1st.	2nd.	3rd.	4th.	Means
1, 4196·699,	*La*,	2......	− 7	+13	− 6	− 1	18	26	12	18	18·6
2, 4197·257,	*Cn*,	2......	0	+ 7	0	−11	28	25	25	20	24·5
3, 4216·136,	*CN*,	2......	+ 7	− 1	+ 8	− 3	40	23	30	31	31·0
4, 4220·509,	*Fe*,	3......	+ 9	+ 2	− 2	− 3	24	16	22	23	21·3
5, 4225·619,	*Fe*,	3......	+20	−12	− 8	0	25	20	28	20	23·3
6, 4232·887,	*Fe*,	2......	−15	+12	− 4	+ 6	21	17	20	14	18·0
7, 4241·285,	*Fe-Zr*,	2......	0	− 7	+ 6	0	25	12	18	21	18·8
8, 4246·996,	*Sc*,	5?.....	−14	+ 5	− 7	+18	25	17	21	19	20·5
9, 4257·815,	*Mn*,	2......	+10	− 4	− 6	0	34	19	13	24	22·5
10, 4258·477,	*Fe*,	2......	+13	− 2	−12	+ 1	21	13	12	15	15·3
11, 4266·081,	*Mn*,	2......	−14	+ 1	+12	+ 2	21	16	19	14	17·5
12, 4268·915,	*Fe*,	2......	− 3	−14	+ 4	+12	21	22	11	21	18·8
13, 4276·836,	*Zr*,	2......	− 4	− 7	− 6	+16	14	13	16	20	15·8
14, 4290·377,	*Ti*,	1......	+ 3	0	− 2	− 2	14	18	14	13	14·8
15, 4291·630,	*Fe*,	2......	− 2	− 8	+ 8	+ 3	14	14	18	10	14·0
		Means...	− 1	− 1	0	+ 2	23	18	18·6	19	19·6

Note.—The above numbers are the means—algebraic (with regard to sign) and arithmetic (without regard for sign)—of the 1st, 2nd, 3rd and 4th settings on the lines in the central strips of the six exposures, *L*699*a* to *L*699*f*, measured both ways; each mean for each line is therefore the mean of 12 settings made at different times.

TABLE VII.

SUMMARY OF MEASUREMENTS OF ARBITRARY DISPLACEMENTS, PLATES *L*699 AND *L*701. MEASURED BY DE LURY.

Line.		Width.	Remarks.		*L*699. (a)	(b)	(c)	(d)	(e)	(f)	*L*701. (a)	(b)	(c)	(d)	(e)	(f)	Means. d	r	p.r.
1, 4196·599, *La*,	2	2020	Diffuse.	d	647	688	764	718	691	708	624	704	640	721	699	717	694	.....	.....
				r	− 31	+ 2	+ 68	+ 22	− 3	+ 1	− 66	+ 5	− 62	+ 22	+ 9	+ 31	.....	0	±26·7
2, 4197·257, *CN*,	2	1660	Asymmetrical.	d	634	798	708	697	707	682	616	701	616	772	675	603	684	.....	.....
				r	− 44	+112	+ 12	+ 1	+ 13	− 25	− 74	+ 2	− 86	+ 73	− 15	− 83	.....	− 10	42·7
3, 4216·136, *CN*,	2	2052	"	d	701	686	702	695	721	741	696	686	720	682	714	715	705	.....	.....
				r	+ 23	0	+ 6	− 1	+ 27	+ 34	+ 6	− 13	+ 18	− 17	+ 24	+ 29	.....	+ 9	14·6
4, 4220·509, *Fe*,	3	1710	Good..........	d	632	725	744	705	688	685	745	726	690	654	687	700	698	.....	.....
				r	− 46	+ 39	+ 48	+ 9	− 6	− 22	+ 55	+ 27	− 12	− 45	− 3	+ 14	.....	+ 4	23·9
5, 4225·619, *Fe*,	3	1990	"	d	735	632	752	639	679	727	673	782	737	723	723	733	711	.....	.....
				r	+ 57	− 54	+ 56	− 57	− 15	+ 20	− 17	+ 83	+ 35	+ 24	+ 33	+ 47	.....	+ 17	34·0
6, 4232·887, *Fe*,	2	1634	Fine..........	d	682	692	743	675	678	635	679	725	700	719	688	665	692	.....	.....
				r	+ 4	+ 6	+ 47	− 21	− 16	− 72	− 11	+ 26	− 2	+ 20	− 2	− 21	.....	− 2	19·7
7, 4241·285, *Fe-Zr*,	2	1409	"	d	688	658	633	733	727	808	736	651	715	751	664	650	701	.....	.....
				r	+ 10	− 28	− 63	+ 37	+ 33	+101	+ 46	− 48	+ 13	+ 52	− 26	− 36	.....	+ 7	34·4
8, 4246·996, *Sc*,	5	2500	Strong, broad.	d	639	644	710	676	709	754	654	656	726	704	664	687	678	.....	.....
				r	− 39	− 42	+ 14	− 20	+ 15	+ 47	− 36	− 43	+ 24	+ 5	− 26	+ 1	.....	− 16	22·7
9, 4257·815, *Mn*,	2	1640	Diffuse.	d	693	599	650	685	677	736	690	763	722	641	702	772	694	.....	.....
				r	+ 15	− 87	− 46	− 11	− 17	+ 29	0	+ 64	+ 20	− 58	+ 12	+ 86	.....	0	34·6

10, 4258·477, *Fe*,	2	1925	Broad	d	692	673	702	683	688	698	703	673	706	675	688	688	689	.....	.....
				r	+ 14	− 13	+ 6	− 13	− 6	− 9	+ 13	− 26	+ 4	− 24	− 2	+ 2	.....	− 5	9·7
11, 4266·081, *Mn*,	2	1710	Fair	d	638	717	676	704	676	673	675	616	759	724	666	645	681	.....	.....
				r	− 40	+ 31	− 20	+ 8	− 18	− 34	− 15	− 83	+ 61	+ 25	− 24	− 41	.....	− 13	27·8
12, 4268·915, *Fe*,	2	1480	Good	d	589	689	649	694	673	695	659	703	649	667	700	631	667	.....	.....
				r	− 89	+ 3	− 47	− 2	− 21	− 12	− 31	+ 4	− 53	− 32	+ 10	− 55	.....	− 27	29·0
13, 4276·836, *Zr*,	2	1590	Diffuse	d	715	670	634	724	702	692	747	700	730	687	662	686	695	.....	.....
				r	+ 37	− 16	− 62	+ 28	+ 8	− 15	+ 57	+ 1	+ 28	− 12	− 28	0	.....	+ 1	22·8
14, 4290·377, *Ti*,	1	2365	Broad	d	744	785	708	697	691	678	743	737	714	735	730	678	717	.....	.....
				r	+ 66	+ 69	+ 12	+ 1	− 3	− 29	+ 53	+ 38	+ 12	+ 36	+ 40	− 8	.....	+ 23	28·1
15, 4291·630, *Fe*,	2	1900	"	d	747	664	667	711	700	688	717	661	701	636	692	724	692	.....	.....
				r	+ 69	− 22	− 29	+ 15	+ 6	− 19	+ 27	− 38	− 1	− 6	+ 2	+ 38	.....	− 2	±25·5
				Mean d	678	686	696	696	694	707	690	699	702	699	690	686	694		
Probable residual single line = $p.r.$					31·6	33·1	29·2	15·5	11·3	27·9	29·5	29·7	26·5	27·2	14·8	29·3	Mean $p.r.$		±26·1
																	"		±26.5

Probable residual of the displacement for a single exposure = ±8·0.

TABLE VIII.

SUMMARY OF MEASUREMENTS OF ARBITRARY DISPLACEMENTS, PLATES *L*699 AND *L*701. MEASURED BY PLASKETT.

Line.		Width.	Remarks.		*L*699. (a)	(b)	(c)	(d)	(e)	(f)	*L*701. (a)	(b)	(c)	(d)	(e)	(f)	Means. d	r	p.r.
1, 4196·599, *La*,	2	2020	Diffuse........	d	683	692	710	704	709	706	693	717	683	693	711	704	700	......	......
				r	− 9	− 2	+ 8	+ 13	+ 5	+ 3	− 15	+ 11	− 23	− 1	+ 14	+ .2	......	0	±7·6
2, 4197·257, *CN*,	2	1660	Asymmetrical.	d	706	716	714	705	719	700	717	702	715	696	681	699	706	......	......
				r	+ 14	+ 22	+ 12	+ 14	+ 15	− 3	+ 9	− 4	+ 9	+ 2	− 16	− 3	......	+ 6	8·4
3, 4216·136, *CN*,	2	2052	" .	d	688	710	689	696	706	702	704	709	699	686	703	705	700	......	......
				r	− 4	+ 16	− 13	+ 5	+ 2	− 1	− 4	+ 3	− 7	− 5	+ 6	+ 3	......	0	5·2
4, 4220·509, *Fe*,	3	1710	Good..........	d	686	693	705	688	695	704	710	694	692	696	706	709	698	......	......
				r	− 6	0	+ 3	− 3	− 9	+ 1	+ 2	− 12	− 14	+ 2	+ 9	+ 7	......	− 2	5·0
5, 4225·619, *Fe*,	3	1990	"	d	703	688	700	686	705	704	696	708	710	696	683	699	698	......	......
				r	+ 11	− 6	− 2	− 5	+ 1	+ 1	− 12	+ 2	+ 4	+ 2	− 14	− 3	......	− 2	4·8
6, 4232·887, *Fe*,	2	1634	Fine..........	d	689	677	695	704	684	696	715	707	703	689	705	695	697	......	......
				r	− 3	− 17	− 7	+ 13	− 20	− 7	+ 7	+ 1	− 3	− 5	+ 8	− 7	......	− 3	6·8
7, 4241·285, *Fe-Zr*,	2	1409	"	d	692	708	704	696	691	710	710	711	707	702	689	716	703	......	......
				r	0	+ 14	+ 2	+ 5	− 13	+ 7	+ 2	+ 5	+ 1	+ 8	− 8	+ 14	......	+ 3	5·8
8, 4246·996, *Sc*,	5	2500	Strong, broad.	d	689	675	693	682	695	700	707	699	701	685	687	689	692	......	......
				r	− 3	− 19	− 9	− 9	− 9	− 3	− 1	− 7	− 5	− 9	− 10	− 13	......	− 8	6·4
9, 4257·815, *Mn*,	2	1640	Diffuse.... .	d	702	675	693	675	717	708	713	711	713	700	698	698	700	......	......
				r	+ 10	− 19	− 9	− 16	+ 13	+ 5	+ 5	+ 5	+ 7	+ 6	+ 1	− 4	......	0	6·7

10, 4258·477, *Fe*,	2	1925	Broad........	d	691	704	697	691	691	703	715	705	716	689	685	701	699	......	......
				r	− 1	+ 10	− 5	0	− 13	0	+ 7	− 1	+ 10	− 5	− 12	− 1	......	− 1	5·1
11, 4266·081, *Mn*,	2	1710	Fair..........	d	679	706	721	682	707	712	698	706	721	700	687	689	701	......	......
				r	− 13	+ 12	+ 19	− 9	+ 3	+ 9	− 10	0	+ 15	+ 6	− 10	− 13	......	+ 1	7·3
12, 4268·915, *Fe*,	2	1480	Good..........	d	681	704	698	682	717	707	712	711	708	696	696	710	702	......	......
				r	− 11	+ 10	− 4	− 9	+ 13	+ 4	+ 4	+ 5	+ 2	+ 2	− 1	+ 8	......	+ 2	5·1
13, 4276·836, *Zr*,	2	1590	Diffuse........	d	691	691	708	684	700	686	711	705	698	702	712	709	700	......	......
				r	− 1	− 3	+ 6	− 7	− 4	− 17	+ 3	− 1	− 8	+ 8	+ 15	+ 7	......	0	5·8
14, 4290·377, *Ti*,	1	2365	Broad.........	d	699	686	705	699	706	696	703	695	713	693	709	704	700	......	......
				r	+ 7	− 8	+ 3	+ 8	+ 2	− 7	− 5	− 11	+ 7	− 1	+ 12	+ 2	......	0	4·8
15, 4291·630, *Fe*,	2	1900	"	d	700	681	695	686	715	710	713	709	711	684	706	700	701	......	......
				r	+ 8	− 13	− 7	− 5	+ 11	+ 7	+ 5	+ 3	+ 5	− 10	+ 9	− 2	......	+ 1	±5·4
			Mean *d*		692	693	702	691	704	703	708	706	706	694	697	702	700		
			Probable residual single line = *p.r.*		9·1	6·0	6·4	7·2	4·6	5·0	4·2	6·8	3·9	7·4	5·0	5·6	Mean *p.r.*		±6·0
																	"		±5·9

Probable residual of the displacement for a single exposure = ±4·1.

The discussion of the results given above can best be made under the headings of the various classes of errors investigated:

Systematic differences in the measurements by different measurers.—A glance at Tables I. and II. reveals the fact there are systematic differences in the measurements made by different persons, and in the general trend the results indicate that those who have had considerable experience in the measuring of stellar radial velocity spectrograms get higher values than those who have had little experience in the measurement of spectra. The differences between the highest and lowest values of the mean displacements are, from Table I., 33, *i.e.*, 0.0033 mm., and from Table II., the same value, 33, representing differences of 6.3 per cent. and 4.8 per cent. respectively. These differences are equivalent to differences of 0.13 and 0.10 km. per second in the determination of the equatorial rate of the sun's rotation from similar displacements. This is a striking difference, and the question arises: Which is more nearly the true value, the high measurement or the low one? and further, What is the true value?—for obviously it is not safe to take the mean value of all the measurements when such systematic errors occur. From the results of a large series of measurements, involving double measures on 12 different exposures (summarized in Tables VII. and VIII.) Mr. Plaskett's measurements are seen in the mean to be systematically greater than mine by 6 in a displacement of about 700. This difference is systematically in the same direction with the exception of the measurements for 2 out of the 12 exposures, and 3 out of the 15 lines, one line giving the same mean. This difference corresponds to 0.02 km. per second, a very small quantity, yet it is in the hundredths of a kilometre per second that nearly all of the interest in the determination of the solar rotation lies at the present time in view of the many interesting results obtained by Adams. It is consequently of considerable importance in such investigations to make allowance and correction for the systematic differences in the measurements of different persons.

Systematic differences depending on the direction of measurement.—A very curious systematic difference in the measurement of the displacements presents itself when measures are made one way and the plate is reversed and measured in the other direction, the face of the plate being up in all measurements. This difference, which apparently is in the same sense for all observers, is exhibited in Table II. where measures of 6 lines on one exposure are given for 6 different measurers, and in Tables III., IV. and V., where my own measurements of 16 different exposures are recorded. It will be seen from Table II. that, with the exception of Mr. Plaskett's measurements which do not show the effect, the first measurement, d', is systematically smaller than d'', the second measurement, for each line with one exception, and for each observer. In the mean, $d''-d'=694-686=8$, a difference corresponding to 0.023 km. per sec. In my larger series of measurements this peculiarity is even more strikingly shown. In the values for *L*641, Table III., we have, $d''-d'=820-806=14$, which corresponds in the region of the spectrum measured, to about 0.04 km. per sec. For *L*699, Table IV., the difference, $d''-d'=699-687=12$, corresponds to 0.034 km. per sec.; and for *L*701, Table V., the difference, $d''-d'=697-690=7$, corresponds to 0.02 km. per sec. In all cases for the measurements of d' the configuration of the lines as seen in the eye-piece of the measuring-machine, was ╎¦, while for the measurements d'', it was the opposite, ¦╎. Furthermore, the carriage was always advanced so that the spider-line of the eye-piece always passed over the central line first, and the 4 settings were made on the central line before passing to the two outside lines. It is not likely that the fact that the d'' measures were made subsequently to the d' measurements has anything to do with this remarkable difference; nor are temperature differences in the micrometer screw caused by the presence of the measurer while securing the values of d' sufficient to account for the larger values

of d''. Nor does the direction of turning the screw account for the difference, for in the measurements of $L641$ the screw was turned in the opposite direction from that used in the other measurements, the central strip being displaced to the red of the two outside strips in it and to the violet side of the spectrum in plates $L699$ and $L701$: to get the same configuration in the microscope for the d' measures it was therefore necessary to start the readings from the opposite ends of the scale for the two opposite displacements. The most plausible explanation of the difference, it seems to me, is a "right-handed and left-handed" effect. The fact that in d' the lines in the two outside strips appear to the right of the line in the central strip, and that in d'' the opposite is the case may produce effects on the eye resulting in this curious difference in the measures of the displacement; and since the right hand turns the screw in opposite ways there may be a muscular effect. I try to eliminate such a thing as "muscular memory" however, by taking a fresh grip on the turning wheel before each setting. Furthermore it must be understood that the field of the microscope is so big that when a setting is made on one of the three lines, the observer is *apparently* not conscious of the presence of the other lines; the above considerations would seem to indicate that the other lines exert some small influence over him nevertheless. In Adams' work on the rotation two strips of spectra were employed, so that the configuration of the lines would be the same in both positions of the plate, and consequently the measured displacements are liable to be too large or too small from such an effect as is here shown to be present. This effect is so large that it must be eliminated from the measurements.

Systematic differences for different lines.—From Table VII. it will be seen that there is a tendency towards negative residuals in my measurements in the cases of lines 8, 11 and 12; and positive residuals for the lines 5 and 14. In Mr. Plaskett's results the tendency to negative residuals occurs in the cases of lines 6 and 8, and positive residuals for lines 2 and 7. Nearly all of these lines have some exceptional characteristic:—line 2, 4197.257, *CN*, is a weak line slightly diffuse and shaded asymmetrically; line 5, 4225.619, *Fe*, is a good strong line with slightly diffuse edges and it is near the strong, broad and nebulous line of *Ca*, 4227, which appears in the field of the microscope during the measurements of line 5; line 6, 4232.887, *Fe*, is a narrow strong line and a good one for measuring; line 7, 4241.285, *Fe-Zr*, is narrow and weak; line 8, 4246.996, *Sc*, is a strong and very broad line but it has sharp edges and is therefore a fairly good line to measure; 11, 4266.915, *Mn*, 2, is a weak line; line 12, 4268.915, *Fe*, is a narrow line with edges slightly diffuse; line 14, 4290.377, *Ti*, is a very broad line with its edges sharp and strong. As seen in the last paragraph it seems very probable that the configuration of the lines plays some part or has some slight effect on the measurements; such being the case it is reasonable to suppose that this effect will vary with lines of different character, and consequently the measured displacements may vary. I made measurements on three dense exposures of the *Ca* line 4227 to see if any exceptional effects were present such as those obtained for this line and for $H\alpha$ by Adams in his solar rotation work. The errors of setting were very large and nothing definite could be found from so few measures. Such measures should be made, and preferably under the same conditions as the rotation plates were measured by Adams and Miss Lasby. The present results show however that there is a danger of systematic errors being present for the various lines, and the differences obtained for individual lines in the rotation work should be very carefully examined by the person making the measurements, at the time they are made preferably, to see if they are due to such systematic errors of measurement.

It will be seen from Tables VII. and VIII., that the probable residuals for the different lines differ greatly, and that my *p.r.* is much greater than Mr. Plaskett's.

This is probably due to the fact that the latter observer has had a great deal of experience in the measurement of the broad diffuse lines of star spectra, and his eye is accustomed to smoothing out the irregularities in the lines due to the grain of the plate, and that I am still bothered by it and have more difficulty in setting on the centres of intensity of the lines. It is to be hoped that more experience will relieve me of much of this error. These errors are combined accidental and systematic, and probably when the systematic errors are removed the residuals will be greatly lessened.

Systematic errors in setting.—In Table VI. are given my errors of setting for the 4 settings on the lines in the central strips (measured both ways) of Plate, *L*699. The numbers are the means of the residuals, with regard to sign and without regard to sign, obtained by subtracting the mean of the 4 settings on any one line from each of the settings on that particular line and taking the means for each line. Though each line has its own peculiar arrangement of the positive and negative residuals for each of the 4 settings —quite striking in some cases—yet there seems to be no general systematic arrangement of these signs. The means without regard to sign show the peculiar and not unexpected result that the first settings are usually farthest from the mean, while the residuals for the other three settings are of about the same magnitude. This peculiarity may be lessened to some extent by viewing the line as a whole more carefully before taking any settings. The mean error of setting is, ± 19.6, or about 0.002 mm., equivalent to nearly 0.056 km. per sec.

The above results were obtained in the measurement of the simplest class of spectroscopic work, namely, the relative positions of the *same* lines, and where therefore systematic errors are not so likely to occur as in investigations where the relative positions of *different* lines are determined; yet, nevertheless, the results show the presence of systematic errors. It may be taken for granted, then, that similar and larger errors occur in other spectroscopic measurements. And since the errors are sufficiently large that their removal is desirable, a general method for the elimination of such errors is necessary. An obvious method of eliminating some of these errors is to make the configuration the same for each measurement. This may be accomplished in the particular case examined above by masking all but each strip of spectrum in turn by means of a slotted sliding mask having a spring stop for each strip. However, in the general case where different lines are compared this would not remove the individual errors of each line, and would not remove any systematic errors of "memory" if they were present. The "double-slit" used above offers a more complete elimination of the difficulty as follows:—

By means of the double-slit, introduce a displacement, D, on the spectra whose normal displacement, d, is desired to be found. By making D much larger than d, it may be assumed (and this point could easily be tested by means of the double-slit) that the systematic errors in measuring $D + d$ are the same as for the measurement of D. Thus let the measured value of the displacement be $D + d + e$, then the measured displacement of D will be $D + e$, and the difference between the two measurements, $(D + d + e) - (D + e)$, will give the true value, d, of the displacement sought. The method is precisely the same as the "method of differences" used in exact weighings. It would involve two parallel series of measurements, but the determination of $D + e$ would probably not need to be made so frequently as the determination of $D + d + e$, after one became somewhat fixed in his habits of measurement. In the investigation of the solar rotation this method could be readily applied. The displacements, d, in our work here range from a little less than 0.1 mm. down to nearly zero, so that by introducing a displacement $D = 1$ mm. in all the rotation spectra the total displacements would be so nearly constant that

very probably the systematic errors of measurement would be the same for all and one determination of $D + e$ for spectra from 6 or 7 different latitudes on each plate would serve to eliminate the systematic errors in the mean. Absolute values, within the limits of the accidental errors, would thus be determined for d, and the results of the measures made by different observers and for different lines should agree very closely. I hope to test the method in the near future and eliminate the errors now present in our work.

Briefly the more important results of the present investigation are:

(1) A method is described for determining the presence and the nature of the errors in the measurements of spectral line displacements.

(2) There are systematic personal errors in the measurements of spectral line positions and displacements.

(3) The errors of measurement, both accidental and systematic, depend on the configuration measured, that is, on the grouping of the several lines in the field of the measuring microscope, and on the characters of these lines.

(4) The effect, on the measurements of different observers, of the configuration employed in the present investigation is in the same sense.

(5) The systematic errors discovered in the present case are sufficiently large to introduce grave errors into one's results and into their interpretation, and consequently one's measurements cannot be accepted as sufficiently accurate without the elimination of these errors. Systematic errors ranging from 0.13 km. per sec. to 0.02 km. per sec. were found in measurements such as made for the determination of the rate of the solar rotation, the value for which at the equator is a little over 2 km. per sec.!

(6) A method for the elimination of these systematic errors is described.

That the systematic errors which occurred in the measurements of the arbitrary displacements, actually occur in the measurements of rotation plates, is seen from the following comparative values of the equivalents (in kilometres per second) to the measured displacements on various plates:

Plates.	*L528a*	*L531a*	*L531b*	*L570a*
Plaskett.............	1.866	1.868	1.872	1.816
De Lury.............	1.851	1.851	1.959	1.716

The necessity for the removal of the errors in our work is thus emphasized. I hope to carry on further work on this question of systematic errors of measurement, and to investigate such influences as intensity of the photographic plate, the magnitude of the displacements, the character of the line with particular reference to the broad lines λ 4227, and $H\alpha$; and especially to test the methods proposed above for the elimination of these errors.

I wish to thank the gentlemen who so kindly made the comparative measurements given here; and Mr. Lucas for constructing the double-slit to work so efficiently.

5. *The Effect of Sky Spectrum on the Determination of the Rate of Rotation of the Sun; and a Note on the General Problem of Blended Spectra.*

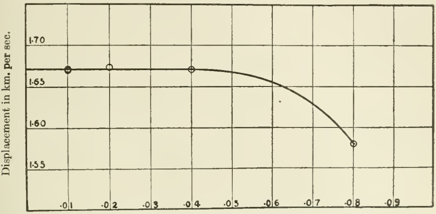
The spectrum taken from any point on the sun is made up of two spectra, one from the point in question and the other from the earth's atmosphere—the "sky spectrum" as it is called. The sky spectrum is produced from sunlight reflected from particles in the space surrounding the earth and in its atmosphere, and partly too by refraction in the latter. Since the sunlight thus redirected comes from the whole of the sun's surface facing the earth, the spectrum lines will be broad and diffuse because the wave-length of any particular line varies over the surface of the sun on account of the effects of rotation, convection and pressure; the centres of intensity of the lines, however, will coincide practically with the centres of inten-

sity of the lines in the spectrum from the centre of the sun's disc. When a photograph of the solar rotation effect is taken the lines in the adjacent strips of spectra from opposite limbs are displaced, while the lines in the sky spectrum blended with it have the same wave-lengths in each of the strips. The measured displacements in these two spectra blended will consequently be less than the actual displacements caused by the sun's rotation. This source of error was noted by Halm and by Adams in their investigations on the solar rotation and observations were taken only on days that were comparatively free from haze in the atmosphere, it being assumed that on the more transparent days when the sky spectrum was much weaker than the sun spectrum, the effect due to the former was negligible. However, since the values measured here for the rate of the sun's rotation at the equator were a few per cent. lower than those obtained at Mount Wilson, it occurred to me that—even though errors of measurement might account for the greater part of this discrepancy—the difference might partially, at least, be accounted for by a difference in the intensities of the sky spectrum in Ottawa and Mount Wilson. I therefore proceeded as follows to estimate and eliminate any effect of the sky spectrum on the measurements.

In the first place an estimation of the relative intensities of the sky spectrum and the "rotation spectrum" was made by exposing for the two spectra in succession. The sky spectra were obtained after lowering the solar image from its usual position when rotation spectra are taken until the little windows in the guide-plate were each about 8 or 10 mm. from the edge of the image. The exposures lasted about 20 or 30 minutes, while the rotation spectra taken on the same plate were exposed for varying times from 5 seconds up to the usual exposure given (30 seconds to 1 minute), so that the intensity of the sky spectrum would be somewhere within the range of intensity of these exposures. In this way a rough estimation of the relative intensities was made possible. The same estimation can be made more quickly by observing or photographing the direct images of the slit reflected back by the grating placed normal to the axis of the spectrograph for the sky and limb of the sun in turn. The visual estimations can be made more readily by narrowing the slit when the limb is examined until the intensity of the reflected light is the same as when the sky light is used. Suitable filters should be used in the latter case to avoid any errors that may be caused by selective effects for the wave-length under consideration. This method was further simplified by masking the primary mirror of the coelostat telescope until the intensity of the reflected image of the slit was as weak as when the sky spectrum with the whole mirror was used. By having the two sources of light quickly alternated, and by estimating closely the two areas of the mirror employed a very accurate estimate of the relative intensities of the sun's limb and the sky can readily be made. Observations by this method agreed closely with the results from the comparisons of the intensities of the two spectra, and they have the advantage over the latter, that changes in the intensity of the sky are less likely to occur during the series of observations. Having determined the relative brightness of the sky with respect to the limbs where the rotation spectra are taken from, varying exposures on the sky are superimposed on the regular exposures of the latter. By measuring the displacements on these blended spectra it is possible to find the effect of sky spectrum on the ordinary rotation plates. The decreasing values of the velocity-equivalent of the displacement are plotted as ordinates with the values of the ratio of the intensities of sky spectrum to rotation spectrum as abscissae; the asymptote to this curve will be the true value of the velocity-equivalent of the displacement caused by the rotation, and the amount that this is lessened on account of the sky spectrum present on the regular rotation spectra is easily determined when the time of the latter exposure is known.

Though a number of plates were made only one has so far been measured, and it is sufficient to show that the effect of sky spectrum on the most transparent day

is very small. The results are shown in the Table and in Figure 14. Further measurements will be made to ascertain exactly the relation existing between the lessening of the displacements due to sky spectrum and the relative intensities of the two spectra for the varying displacements of the different latitudes, after the errors of measurement of the displacement are under careful control.



Ratio of intensities of overlapping sky and rotation spectra.

Fig. 14.—The Effect of Sky Spectrum on the Measurements of the Solar Rotation.

The Effect of Sky Spectrum in lessening the Measured Displacements of the Spectrum Lines caused by Rotation at the Solar Equator.

Rotation Exposure Sky Exposure Ratio, Sky: Rotation			1 minute 1 minute 0·01		1 minute 1 minute 0·01		1 minute 2 minutes 0·02		1 minute 4 minutes 0·04		1 minute 8 minutes 0·08	
Line.			*d*	*v*	*d*	*v*	*d*	*v*	*d*	*v*	*d*	*v*
1, *La*,	2,	4196·699	818	1·794	747	1·638	771	1·691	775	1·699	752	1·649
2, *CN*,	2,	4197·257	769	1·686	809	1·774	758	1·662	783	1·717	710	1·557
3, *CN*,	2,	4216·136	773	1·687	762	1·663	793	1·731	748	1·633	674	1·471
4, *Mn*,	3?,	4220·509	749	1·633	773	1·685	755	1·646	790	1·723	763	1·664
5, *Fe*,	3,	4225·619	709	1·544	666	1·450	777	1·692	705	1·535	726	1·581
6, *Fe*,	2,	4232·887	745	1·620	768	1·670	756	1·644	749	1·628	690	1·500
7, *Fe-Zr*,	2,	4241·285	769	1·668	773	1·677	778	1·688	786	1·705	752	1·632
8, *Sc*,	5?,	4246·996	762	1·651	774	1·677	748	1·621	743	1·610	741	1·606
9, *Mn*,	2,	4257·815	748	1·617	760	1·643	797	1·722	780	1·686	702	1·517
10, *Fe*,	2,	4258·477	856	1·850	872	1·884	777	1·679	800	1·729	735	1·588
11, *Mn*,	2,	4266·081	736	1·588	739	1·594	757	1·633	746	1·609	733	1·581
12, *Fe*,	2,	4268·915	759	1·636	811	1·748	795	1·714	771	1·662	740	1·595
13, *Zr*,	2,	4276·836	764	1·644	765	1·646	767	1·650	768	1·653	717	1·543
14, *Ti*,	1,	4290·377	800	1·716	764	1·639	777	1·667	815	1·748	742	1·592
15, *Fe*,	2,	4291·630	804	1·724	768	1·647	781	1·675	803	1·722	757	1·623
		Means		1·671	.....	1·670	....	1·674	.....	1·671	.....	1·580

Note.—The intensity of the limb of the sun was approximately 100 times as great as that of the sky when the exposures whose measurements are given in the Table were made. The mean values of *v* for the different values of the ratio, Sky: Rotation intensity are plotted in the accompanying Figure 14. It would appear that somewhere between the values, 0·04 and 0·08 of the ratio of the intensities of the two spectra the weaker begins to affect the measurements of the stronger spectrum. The measurements of the second column are a repetition of those of the first.

The method employed here, namely, the blending of known spectra in known ways and measuring the resultant lines, would yield results of considerable value in the solution of certain astrophysical problems in which the question of blended spectra is an important one. By suitably blending the spectra under consideration, or similar spectra, definite laws could be established connecting the positions, characters and intensities of spectra and of individual lines with the measured positions of the blended spectrum lines, which could be applied to the problem investigated. Such data are necessary in making a complete solution of the following important problems:

(1) The more minute investigation of the spectra of stars the peculiar results from the measurements of which have been explained by the blending of two or more spectra known or suspected to be present.

(2) The determination of the rates of rotation of stars which has been suggested possible in the case of eclipsing variables* by studying spectra taken at various stages of the eclipse. Though there are many difficulties in the way of this problem† one of the first things to consider is the blending of spectra which in general would occur.

(3) The investigation of the question of the presence of an independently moving haze or envelope between the observer and the source of light—a problem which occurs in the investigation of the sun and of variable stars, and for solving which, data concerning blended spectra are necessary.

It thus appears that the study of arbitrarily blended spectra would yield profitable and necessary results. In connection with the solar work I hope to make such arbitrary measurements by blending the spectra from the centre of the disc and limb at the equator to find any general laws connecting the amount of displacement, intensities of the two spectra and character of the spectral lines, with the measured positions of the lines.

6. *Convection in the Atmosphere of the Sun.*

The question of convection in the atmosphere of the sun or of a star is one of very great importance. In our present theories of their constitution convection currents play a vital part. They must operate ceaselessly in all stellar atmospheres to maintain radiation; and variations in the latter may be reasonably attributed to changes in the convection currents supplying it. So much impressed was I by this idea, that in a paper entitled "Convection and Stellar Variation," read before the Royal Astronomical Society of Canada,‡ in March 1909, and before the Royal Society of Canada§ in May of the same year, I attempted to explain in this manner certain general conclusions from the photometric and spectrometric data of variable stars. A quotation from this paper will briefly present views discussed there:

"It is supposed that the star is a body condensing under the action of gravity and developing great quantities of heat which give rise to rapid radial convection currents bearing masses of hot gases from within and cooler and condensed materials back to the interior, and that, in the absence of disturbing agents, a "kinetic equilibrium" is established resulting in a steady and practically constant total emission of light by the star. Since the radiation from the star depends on the velocity and character of its convection currents, any change in these convections causes a change in the heat and light emitted. Consequently, to account for the variations in the light of some stars, it is assumed that there are changes in the convection currents of the stars caused by the changing action of disturbing agents.

* J. Miller Barr, Jour. Roy. Astron. Soc. Can., 3, 50. George Forbes, M.N., LXXI, 578.
† Frank Schlesinger, Pub. Allegheny Obs., I., 134; M.N. LXXI., 719.
‡ Journ. Roy. Astron. Soc. Can., III., 344–355.
§ Trans. Roy. Soc. Can., Series III., Vol. III., Sec. III., 227–236.

"The nature of these convection currents is revealed to some extent by the study of the sun's atmosphere. Short-exposure photographs of parts of the sun's surface taken on a large scale at intervals of less than a minute apart by S. Chevalier* show that the granulation of the photosphere is undergoing very rapid change, and we may attribute this to the rapid radial currents which exist throughout the entire atmosphere of the sun. The spots, faculae and prominences, which may be regarded as accentuated developments of the general currents, change continuously and frequently exhibit great velocities in their radial and transversal movements. The number and areas of these disturbed regions vary in a period of average length about 11.2 years, and in about the same period the regions in which the spots are most abundant change in latitude in the north and south hemispheres. It is not yet known whether the convection currents over the entire surface of the sun vary periodically, yet at least the enlarged convections or their results—if we may so term the spots, faculae and prominences—undergo periodic variations causing changes in the radiation from the regions affected. Now although these changes may not be great enough to modify seriously the total radiation of the sun, nevertheless in the case of variable stars we may assume that similar changes on a larger scale account for the light-variations." . . . The paper then goes on to discuss the possibility of "induced" actions resulting from disturbances in a stellar atmosphere, the different effects for different gases, and the shifts in spectral lines resulting from changes in convection—it being assumed that the ordinary heat convections are accompanied and supplemented by electrical convections and changes in the positions of electrical discharges or glows to account for the largest changes in wave-length; then in the light of this theory the different classes of variations of stars are discussed.

As will be seen from the context I regarded the question as to "*whether the convection currents over the entire surface of the sun vary periodically*" as one of great importance, and I wish to emphasize here the necessity of investigating this subject of convection in the solar atmosphere, and to urge that it be added to our programme of work with the solar spectrograph.

While preparing the above-mentioned paper I made plans for commencing the investigation of general solar convection currents, but during the year 1909 the work with the spectrograph was confined to the problem of the solar rotation and numerous incidental tests, employing the old grating which yielded such poor results; this work was continued in 1910 with new and better gratings, so that it was not until December 1910 that I made the attempt to take plates of the convection effects. However I succeeded in taking only one plate, *L*626, which was underexposed, and as this work seemed to interfere with the work on the solar rotation it was abandoned until a more favorable opportunity presented itself. The method which I proposed to use consisted in taking side by side and simultaneously, spectra from various points on the sun's surface which lie in the plane containing the centre of the earth and the axis of the sun, and which therefore give no displacement of the spectrum lines due to the sun's rotation; measurements of the changes in wave-length in these plates would give data for calculating the magnitude of the convection velocities, though it might be involved with such considerations as blended spectra, pressure, etc. The region selected for *L*626 was at the *D* lines where it was thought the presence of the earth's atmospheric lines would be useful in eliminating instrumental errors and certain errors of measurement. The apparatus necessary is a reflecting prism arranged so as to reflect the light from any point inside the limb of the sun to another prism placed above the slit so as to direct this light through the slit to the grating; at the same time light

* Astrophysical Journ., 27, 12–24, 1908.

from the centre of the sun's disc goes directly through the slit and the spectra from the two points are photographed side by side so that the relative wave-lengths may be determined. Half of the prism system employed in the solar rotation work would serve for this purpose with possibly a longer rack for the limb prism. It may be that the magnitudes of the velocities exhibited by the ordinary absorption lines may not be large enough for my purpose; in that case I would employ the high-level lines H and K which have in the meantime been investigated by Charles E. St. John.* The results he has found regarding the convectional movements of the vapors producing the various components of these lines are in striking accord with the theories presented in my paper on "Convection and Stellar Variation" quoted above. For example he finds that: "The calcium vapor producing the absorption line K_3 in the solar spectrum has a descending motion over the general surface of the sun of 1.14 km. per second in the mean," and "The calcium vapor to which the bright emission line K_2 is due has an ascending motion over the general surface of the sun of 1.97 km. per second in the mean." Now if on investigation such velocities be found to vary over the sun-spot period, the "convection theory" of the variability of stars would receive some confirmation; but even if these results do not turn out as I hope they will, yet they will be of sufficient importance to warrant the carrying out of the investigation, for the solution of other solar problems is not complete without recognition of the effects of convection.

I wish to suggest therefore that the programme of solar research be widened to include a thorough investigation of the general convections in the solar atmosphere and any periodic changes that may take place in them, and that the necessary conveniences be provided soon to take advantage of the present sun-spot minimum and the sudden rise to maximum which is likely to follow. It seems to me that the problem of the solar rotation—at present the main solar problem under investigation here—should be studied simultaneously with convection effects, pressure effects, sky spectrum and blended spectra, and the incidental errors of measurement, for results may be obtained from the former investigation which would be inexplicable without data of these other effects obtained simultaneously; and, as suggested in the last report, a more perfect photography of the sun should be made with the aid of the reflecting telescope.

7. *The Effect of Air Currents in Spectrographs.*

During the latter part of the autumn of 1910, a puzzling annoyance was encountered while working with the solar spectrograph: the image of the spectrum became disturbed from time to time: the disturbance resembled that which resulted from tapping the spectrograph gently or from kicking the cement piers on which it rested: the trouble was greater on bright frosty days when the sun spectrum was examined, than it was at any time during a couple of weeks of warmer, cloudy and rainy weather when the spectrum from a carbon arc was examined: on several occasions marked disturbances were observed simultaneously with the sound of slamming doors or of heavy waggons rumbling on the road above the tunnel in which one end of the spectrograph is placed.

The definition of the spectrum was so much impaired by the disturbance that for a month no satisfactory spectra could be photographed. We had great difficulty in finding the cause of the trouble. The fact that Dr. Klotz recorded marked microseisms on two of the frosty bright days when the disturbance was exceptionally great, made us suppose that it might be due to some earth waves accompanying those recorded on the seismograph. The vibrations caused by the machinery in the machine-shop adjoining were also suspected, but stopping the

* Astrophysical, Journal, 32, July, 1910.

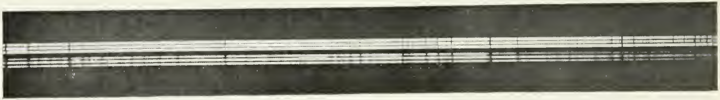


Fig. 15.—Rotation Spectrum Photographed without and with Air-Currents in the Spectrograph.

machinery did not affect the disturbance. Truss-rods were placed on the spectrograph, but though they gave it necessary strengthening, they did not lessen the trouble. Finally one day when the cold currents blowing in under a door near the grating end of the spectrograph were exceptionally strong, it occurred to me that the disturbance might be due to cold air passing into the spectrograph and over the face of the grating, and sure enough this last guess proved to be right, Mr. Plaskett observing the effect on the next bright day when the sun spectrum was examined. By observing the face of the grating without the eye-piece used in examining the spectrum, waves were seen to be passing over it suggesting the appearance of a volcano.

The greatest effect was caused by the cold air from the room which was suddenly cooled by opening the doors leading to the coelostat-house to admit the light from the reflector; this cold air fell through a small hole which had been placed directly above the face of the grating when some additions were made to the spectrograph earlier in the autumn. In the most extreme cases the room was chilled to a temperature from 10° to 15° C. lower than that in the spectrograph, and the initial influx of air to the latter was so great as to utterly ruin the definition of the spectrum. This effect is illustrated in the accompanying Figure 15, which is taken from plate *L*621, II order, λ 5600, and reproduces a sharply defined rotation spectrum taken in the absence of air currents in the spectrograph—a condition secured by plugging the holes in the spectrograph with felt—and a poorly defined spectrum taken immediately afterwards while air currents were passing over the face of the grating. These currents were caused by leaving the doors open for five minutes and allowing the room to cool from 20° to 12° C. and then removing the plugs of felt from the holes in the spectrograph near the grating. This of course represents an extreme case, but it will serve all the better as a warning to those who are likely to meet with the same trouble in employing spectrographs of the closed-in type.

The disturbance was eliminated by lining the spectrograph with felt, and by putting a double box around the grating end of the spectrograph, lining it and plugging all holes with felt and cotton waste. Conditions were further improved by putting a pane of plate-glass in one of the doors leading out to the coelostat-house, thus making it possible to get light from the reflector to the spectrograph without cooling the room.

The above observations are recorded in the hope that others who are engaged in spectroscopic work may avoid the troubles we have experienced. In the use of stellar spectrographs, it seems to me, there is a danger of similar effects from air currents. The spectrograph is usually kept a few degrees warmer than the room in which it is used by an electrically controlled and heated thermostat, and the resulting convection currents may cause a slight effect; and further, cold air leaking in through the narrow slit may slightly impair the definition of the spectrum and greatly lessen its intensity on account of the changes in refraction which would cause some of the light passing through the slit to be deviated so that it would not fall on the collimating lens and prisms. The point could easily be tested and if the effects were present they could be removed by placing a thin piece of plate-glass over the slit, or immediately under it.

8. *Distortion and Dispersion of the Solar Image by the Earth's Atmosphere.*

Some marked effects of distortion and dispersion of the sun's image, produced by the terrestrial atmosphere, have been noticed from time to time while working with the reflecting telescope and while taking the daily photograph of the sun with the equatorial telescope and solar camera. These effects are most pronounced

during the winter months when the declination of the sun is least. On one occasion when the definition produced by the reflector was excellent, the following measurements of these effects were made. The angles refer to the readings on the graduated circular front of the solar spectrograph, corresponding to the direction of the diameter of the solar disc measured; the "diameter over all" includes the colored part due to the spectrum, and "diameter over white" is the diameter leaving out the red and blue edges of the image.

Angle 260°, "East and West line"	Diameter over all	230·0 mm.
	Diameter over white	228·0
Angle 170°, "North and South line"	Diameter over all	226·0
	Diameter over white	224·8
Angle 300°, "No color line"	Diameter	232·0
Angle 305°,	Diameter over all	231·0
	Diameter over white	230·8
Angle 210°–215°, Direction of Spectrum	Diameter over all	224·0
	Diameter over white	222·0
Hence, the length of the spectrum is		2·0
The greatest diameter of the monochromatic image is perpendicular to the direction of the spectrum, and equal to		232·0
The least diameter of the monochromatic image is along the direction of the spectrum, and equal to		223·0
Hence, the distortion effect is		9·0

The observations were made December 12, 1910, 3:35—3:50 p.m. The day was particularly calm and cold, and fairly stable layers at different temperatures may have existed in the atmosphere.

From the above measurements it will appear that when the sun is low it is not safe to make observations where a knowledge of the position of the points on the sun observed is essential; during the winter months observations should be made about the noon hour, when, unfortunately, the coelostat-house is in shadow. Furthermore the photographs of the sun taken in the winter time should be made as near noon as possible. Is it possible that small effects similar to those noted here, may have affected the investigations which have been made to detect any changes in the diameters of the sun? I understand that correction for atmospheric refraction has been made in the ordinary way, but may there not have been present frequent minute irregular distortion effects operating so as to increase the probable errors of the measurements greatly and thus discouraging attempts to detect the most minute changes? It appears that the question has been abandoned even though Poor's investigations—in spite of the large probable errors present—seemed to indicate periodic changes in the diameters of the sun.

9. *Suggestions for Future Work and New Apparatus.*

A brief outline will here be given of suggestions I wish to make relating to future work and new apparatus, the necessity for some of which has been discussed in the preceding part of this report. Nearly all of these suggestions while having a direct bearing on the problem of the solar rotation, relate to questions important in themselves.

(*a*) *Solar Rotation and Related Work.*—In the foregoing Report I have shown the necessity of determining the slight effects on the measurements of the rate of the solar rotation caused by the following:—Errors of Measurement, Sky Spectrum, Convection and Pressure. I have pointed out methods of determining these effects. In this connection the "rotation plates" could be made more valuable by including a simultaneous exposure on the centre of the sun; this could be done with very little extra trouble. It might be advisable to alter the present unsymmetrical configuration of the spectra (which consists of two exposures from one limb and one from the other) and have two strips of spectrum from each limb, with a narrow strip from the centre in between each set. Two settings on the line in each strip—10 settings in all—would yield information regarding pressure and convection effects and would give more data for the determination of the rate of the solar rotation than is given by the 8 settings to a line in the three strips of spectrum now used. The labor and time of making the settings can be much lessened, and the accuracy in recording them can be put beyond question, by employing an automatic register of the settings. I have devised a simple photographic method (see below) of accomplishing this.

(*b*) *Periodic Changes in the Velocity of the General Convection Currents in the Solar Atmosphere.*—As mentioned in the preceding part of the Report, I have raised the question—in a paper entitled, "Convection and Stellar Variation" (*loc. cit.*)—as to periodical changes in the convection currents in the solar and stellar atmospheres and the bearing of such changes on the variation of solar and stellar radiation. I regard the question as a very important one, and it seems to me that much light can be thrown on the general problem by a study of the solar convection currents. Apart from its own importance it may have an important bearing on the problem of the solar rotation. It is quite possible that a thorough knowledge of the convectional movements—their velocities and magnitudes—in the sun's atmosphere, may provide the key to unlock the mystery of the greater angular velocity of the lower latitudes. Indeed, it does not take a very great stretch of the imagination to conceive that the rotation of stars and the consequent throwing off of satellites, may have been developed by the growth of convection currents fed by the energy liberated during the condensation under the action of gravity of matter initially in a very tenuous condition.

I would therefore urge that time and equipment—very little extra apparatus is needed to start the work—be granted me for the investigation of the general solar convection. Very likely the motions of the ordinary absorbing gases are not rapid enough to cause a suitably large displacement for measurement, and particularly for detecting changes in velocity. Adams, in his comparisons of the centre and limb of the sun, finds a slight displacement which he attributes to pressure, but which in the absence of a very accurate laboratory comparison could be ascribed to convection. However, the more rapidly moving high-level vapors of Calcium and Hydrogen can be investigated from their emission and absorption lines, and their velocities are sufficiently large (as St. John has recently shown, for Calcium, *loc. cit.*) to make it possible to detect periodic changes of 1 per cent. or more. In such work it is essential—as I pointed out in the last Report—to photograph simultaneously, a gaseous absorption comparison spectrum produced by tubes of gas of known pressure.

(*c*) *Proposed New Arrangement of Reflecting Prisms for the Solar Rotation Work.*—By using the arrangement of the central reflecting prisms of the solar rotation apparatus shown in Figure 16, the resulting "rotation plates" will be considerably more valuable than the ones taken at present. By this arrangement two

sets of rotation spectra are photographed simultaneously with the spectrum from the centre of the sun's disc; the width over all of the five strips and spaces between them could be, conveniently, about 5 mm. In measuring these spectra, two or three settings to a line in each strip would be sufficient. From the double set of rotation measures it would perhaps be possible to cast out honestly, very discrepant individual measures occurring in only one of the sets and independent values for each limb could be determined; and comparisons with the spectrum from the centre of the solar disc could be made to determine the effects of pressure and convection. Likewise changes in the character of the lines between centre and limb would be recorded. Since the tips of the prisms are rather thin, difficulty might be experienced in grinding them out of a solid piece of glass: in that case they could be made from strips of glass of the required thickness cemented to a central block of glass, for convenience of adjustment.

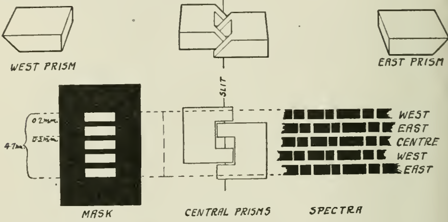


FIG. 16.—A proposed arrangement of Reflecting Prisms for the Solar Rotation Apparatus.

(*d*) *Photographic Method for Recording Micrometer Readings.*—To lessen the labor involved in the measurements of the spectrum line displacements on the "rotation plates," and to increase the accuracy of these measurements I have devised a photographic method of recording the readings on the drum of the micrometer. I understand that the printing method which has been used for this purpose* would be very expensive if applied to the large Toepfer measuring machine; but I think the following apparatus could be constructed at much less expense. The apparatus would consist essentially of a small short focus camera provided with an automatic shutter, and a key (similar in action to a typewriter key) which when pressed after a setting had been made, would release the camera shutter, and which when released would shift the film or plate in the camera over a suitable distance for the next exposure. The camera would be set up so as to photograph the reading on the silvered micrometer drum which would be illuminated by artificial light of sufficient intensity to give a good exposure in say half of a second as regulated by the automatic shutter. Suitable masks would be employed so that only the necessary part of the scale on the drum would appear on the photographic plate or film. The readings would be photographed on such a small scale that a great number could be placed on a small plate or film, and enlarged prints would be made from the negative so that the readings could be readily determined

* Zeit für Instrumentenkunde, p. 169-173, 1910.

without the aid of a magnifying glass. The readings for each spectrum line would be taken in a row and the plate or film advanced slightly for the next row of photographs. By using a small plate in a plate-holder which could be immersed in developer and fixer, the after treatment of the plate could be carried on during other measurements, thus saving much time. The mechanism for shifting the plate from reading to reading, and for advancing it from row to row could be arranged like that of a typewriter for shifting the platen from letter to letter, and for advancing it from line to line. I have discussed these details with Mr. Mackey who thinks he could construct the apparatus without much difficulty and expense, so I would suggest that it be provided for use with the large Toepfer measuring engine.

(e) *Apparatus for Removing Systematic Errors of Measurement.*—In the preceding part of this report I have shown that there are systematic errors present in the measurements of the displacements of the spectrum lines in the rotation plates, and that these errors are due to the configuration of the lines visible in the eye-piece of the measuring machine. I suggested there methods of eliminating such errors. One of these methods is to make the configuration the same for the measurements of the spectrum line in each of the strips of spectrum. This can be done by placing a mask just above the photographic plate to be measured, the mask to have a slit just wide enough so that one strip of spectrum may be seen at a time, and the mask to be movable so that the three strips may be seen in turn. Any influence on the setting on any particular spectrum line, by what is visible in the eye-piece will be the same for each strip and consequently the systematic errors due to configuration will be eliminated in the displacement determined by subtracting the readings for one spectrum from the readings for the other. I would suggest that such an apparatus be fitted to the large Toepfer measuring machine. It could be conveniently attached to the sturdy arm supporting the microscope. A light frame holding the slotted slide which can be moved between spring stops bringing the slit above each of the three strips in turn by means of a turning handle on the left side of the eye-piece support, is all that is necessary. More stops than three should at the same time be provided for the measurement of exposures having more than three strips of spectrum, and the slotted slide should be so mounted that it could easily be moved out of place in order to see all the strips of spectrum for purposes of adjustment.

Photography of the Sun.

The photography of the sun with the enlarging camera of the equatorial telescope was continued during the year, photographs being taken on nearly every bright day. On a number of bright days when the sun shone for just a short time, the photograph was missed because I was working with the solar spectrograph. However, nothing of very great importance was missed, it is hoped, because the number and size of spots are fast declining to the minimum. Until nearly the end of January the photographs were taken, as they have been from the beginning, on the coarsely grained Cramer's Medium Isochromatic plates, which are so sensitive to the light admitted through the "Filtergelb K" screen employed. For two reasons the definition on the photographs is not what it should be: firstly, because minute crystals have appeared in the Canada balsam used to stick the Filtergelb plates together—probably due to the action of the sunlight; and secondly, because the grain of the plates is so coarse. Through the end of January and February the finer-grained though somewhat slower Wellington Ortho Process plates were employed; while during March the plates employed were Cramer's Iso Process which proved to be of still finer grain and nearly as fast as the Cramer's Medium Isochromatic plates formerly used.

Regarding the treatment of the plates after being exposed, I would suggest that arrangements be made for developing them immediately after being taken, or perhaps two at a time, rather than having them accumulate month after month as at present.

I would again urge that a camera be installed for use with the reflecting telescope, for special photographs at least. For ordinary purposes the photographs taken as at present may serve; but no record of the white spots and granulation is made on these plates owing to the fact that the yellow filter employed cuts off the violet rays from the Calcium vapor to which the brightness of the white clouds in the sun's atmosphere is chiefly due. Such a record could be made on Process plates with the reflector, and these photographs taken at the time when rotation plates are made would serve perhaps to trace out the cause of certain irregularities appearing in the latter, though a spectroheliograph would do this much better.

Laboratory Work.

Owing to the pressure of other work, little time was found for work in the laboratory outside of the work on testing developers for use with the various photographic plates employed in taking the rotation plates, the plating of the mirrors, and numerous little points occurring in connection with our solar work and that of other members of the staff.

In connection with the investigation of errors of measurement—discussed in the first part of this report—I made 6 plates, $(X_1 - X_6)$, of artificial spectrum lines of varying character and intensity. These artificial lines were made by exposing the photographic plate to a small source of light through the double-slit described above. In this way emission lines displaced similarly to the displacements of the absorption lines on the rotation plates were imitated. By making a positive from this plate the absorption lines were themselves represented. The double-slit was placed close to the photographic plate in a frame in which the plate-holder could be slid from exposure to exposure. The source of light consisted of a ground glass bulb placed behind diaphragms having holes of different shapes. These holes were made in small slides which could be readily interchanged, and their shapes controlled the character of the imitation spectrum lines. A rectangular opening gave a fairly uniform line, a diamond shaped hole gave a shaded line, two holes side by side produced a close double or a blend, etc. By suitably arranging the openings any kind of spectrum line or blend could be very closely imitated, and either emission or absorption lines could be produced. By means of the double-slit adjustments the displacements of these lines and their sharpness could be controlled. It was my intention to obtain from these plates the effects by gradual changes of intensity, character and displacement on the systematic errors of measurement. However, I considered it advisable for the first work in the investigation of errors of measurement, to find the errors in the measurements of the spectrum lines actually employed by us for the determination of the solar rotation, and of those lines found by Adams to give systematic differences from the mean values. In connection with this latter investigation I have devised means of eliminating the errors, so for the present time I have abandoned the work with the artificial lines, though their measurement would probably reveal more readily than any other measures the general effects of the various factors just mentioned, for changes in the latter can be so easily regulated. It might also afford the easiest method of determining one's tendencies in the measurement of blended spectra, for the character, intensity and distances apart of the lines forming the blend can be controlled so perfectly.

In the last Report I emphasized the necessity of employing gaseous absorption spectra photographed simultaneously with the Solar spectra for the purpose of detecting minute changes in the latter. I plan to prepare tubes of various gases and to investigate their absorption spectra. The colored gases such as the halogens, peroxides of nitrogen, chromyl chloride, etc., are available; and possibly too, many of the more transparent gases may be used with the long-focus telescopes and spectrographs now in use. It is possible that a long tube can be filled with several gases to produce absorption lines at the various wave-lengths. Many of these gases should be investigated and the wave-lengths of the best comparison lines determined accurately. Furthermore, it may be practicable to use as comparison substance the vapour of a metal. The metal could be heated in a tube at low pressure and the sun-light passed through it; and if the metal occurred in the Sun, the light from one end of the solar equator could be passed through the tube: with great dispersion the lines would be shifted so much that the fine lines of the solar and comparison spectra would not blend.

APPENDIX E.

DOUBLE STAR MEASURES, OCCULTATIONS, AND HALLEY'S COMET.

R. M. MOTHERWELL, M.A.

DOUBLE STAR MEASURES.

The measurement of double stars has been carried on as in former years, but the presence of Halley's Comet interfered considerably with the work. The quick motion attachment for position-angle has been found very satisfactory. Acting on suggestions from Prof. Doolittle and Prof. Fox, I am giving the usual designation to each star in addition to its general catalogue number.

70	OΣ 2.	
	°	"
1910·690	224·1	17·32
1910·791	224·3	17·56
1910·741	224·2	17·44

117	Σ 21 rej.	
	°	"
1910·796	51·0	7·75
1910·802	51·0	7·48
1910·816	51·6	7·61
1910·805	51·2	7·61

134	H 1015	
	°	"
1910·791	143·7	6·34
·796	145·3	6·66
·802	142·9	6·31
1910·796	144·0	6·44

269	Espin	
	°	"
1910·701	114·7	5·91
·745	113·6	5·69
1910·723	114·2	5·80

Identified as No. 246 by Burnham in A. N. 4426

319	A. G. 6	
	°	"
1910·796	11·0	59·56
·802	11·0	59·28
·816	11·4	59·15
1910·805	11·1	59·33

578	Σ 89 rej.	
	°	"
1910·745	159·3	15·64
·796	160·0	15·60
1911·045	159·5	15·74
1910·862	159·6	15·66

684	Kr 11	
	°	"
1911·045	240·5	2·35

1002	Σ 183	
	°	"
1910·791	164·2	5·65
·796	163·9	5·66
1910·794	164·1	5·66

1186	Tucker	
	°	"
1910·802	238·1	2·76

1216 A. G. 36

	°	″
1910·791	224·4	3·55
·816	222·5	3·25
·930	227·4	3·33
1911·046	223·3	3·23
1910·896	224·4	3·34

1223 A. G. 37

	°	″
1910·701	290·9	5·02
·745	291·3	4·79
1910·723	291·1	4·91

1239 A. G. 38

	°	″
1910·701	261·2	34·02
·791	260·5	33·77
·802	260·3	34·02
1910·765	260·7	33·94

1622 A. G. 64

	°	″
1910·791	245·0	8·70
·802	244·1	8·68
1911·046	244·5	8·52
1910·880	244·5	8·63

1655 β 1294

	°	″
1910·791	228·9	6·49
·802	228·1	6·32
1910·797	228·5	6·41

1750 A. G. 68

	°	″
1910·791	248·7	17·22

2043 Σ 72

	°	″
1910·936	322·4	3·84

2119 A. G. 79

	°	″
1910·791	109·8	25·28
·802	110·1	24·83
·904	110·5	24·76
1910·832	110·1	24·96

2232 Σ 556 rej.

	°	″
1910·936	288·1	3·93
1911·046	286·2	4·62
1910·991	287·2	4·28

2536 Σ 643

	°	″
1910·791	300·3	2·74

2634 Σ 678

	°	″
1910·791	99·2	3·26
·802	98·0	3·02
·904	99·2	3·33
1910·832	98·8	3·20

2648 Σ 682 rej.

	°	″
1910·937	98·5	19·01
1911·046	99·4	18·57
1910·992	99·0	18·79

2697 H 364

	°	″
1910·937	141·4	9·87

3334 A. G. 110

	°	″
1910·791	327·3	10·72
·802	327·9	10·55
·904	327·5	10·51
1910·832	327·6	10·59

3348 A. G. 111

	°	″
1911·051	163·4	6·67
·084	164·8	6·76
1911·067	164·1	6·72

3399 A. G. 115

	°	″
1911·051	351·0	3·81

3946 Σ 1058

	°	″
1910·937	281·4	22·11

4530 H 781

	°	″
1911·051	139·6	5·65

5019 Σ 1330 rej.

	°	″
1910·279	302·0	24·99

5125 A 224

	°	″
1910·279	146·1	3·56

5337 Σ 1412 rej.

	°	″
1911·090	294·5	29·83

6030 Σ 1601

	°	″
1910·284	309·5	2·63

6386 β 930

	°	″
1910·284	118·7	....

6415 OΣ 261

	°	″
1910·306	343·7	1·89

6599 Σ 1777

	°	″
1910·254	229·6	3·64

6753 H 3343

	°	″
1910·489	213·4	63·36

7065 OΣ 289

	°	″
1910·306	115·5	4·56
·489	114·4	4·62
1910·398	115·0	4·59

7429·5 A. G. 199

	°	″
1910·254	253·4	9·57

7480 S 676: ρ Coronæ

	°	″
1910·383	76·9	84·55

7604 Σ 2038 rej.

	°	″
1910·306	212·31	16·69

7918 Ho 558

	°	″
1910·572	208·9	7·71

7927 Σ 2141 rej.

	°	″
1910·383	125·7	33·33

7930 Σ 2144 rej.

	°	″
1910·681	180·9	24·56

8003 Σ 2161

	°	″
1910·567	313·6	3·88
·572	313·0	3·67
1910·570	313·3	3·78

8431 H V 93

	°	″
1910·681	136·0	53·82
·706	136·1	53·72
·777	135·9	53·87
1910·721	136·0	53·80

8432 H 856

	°	″
1910·681	62·4	Clouds
·706	62·3	24·50
1910·694	62·4	24·50

8481 H 5494

	°	″
1910·706	70·2	39·43

8504 Σ 2310

	°	″
1910·706	237·5	5·25
·777	236·0	5·18
1910·742	236·8	5·22

9107 Schj. 20

	°	″
1910·638	229·9	59·54
·660	229·8	59·47
1910·649	229·9	54·51

9181 H 5509

	°	″
1910·638	104·8	6·78
·706	103·1	7·10
1910·672	104·0	6·94

9183 A. G. 228

	°	″
1910·651	102·5	36·13
·660	102·3	36·45
·668	102·4	36·53
1910·660	102·4	36·37

B.D. 63°, 1501 and 1502

	°	″
1910·668	156·4	78·66

B.D. 63°, 1505 and 1506.

	°	″
1910·638	103·8	24·54
·660	103·3	24·01
·668	103·4	24·76
1910·655	103·5	24·44

9905 H 1477

	°	″
1910·627	270·8	19·37

9970 Espin 87

	°	″
1910·534	298·5	8·71
·627	298·1	8·92
·638	297·6	8·83
1910·600	298·1	8·82

9986 H 907

	°	″
1910·580	132·5	5·79

10005 Σ 2649

	°	″
1910·627	151·5	23·28
·638	151·4	23·07
·668	151·4	23·56
1910·644	151·4	23·30

10064 Ho 588

	°	″
1910·627	297·5	49·75
·638	297·4	49·79
·668	297·4	49·60
1910·644	297·4	49·71

10066 Ho 455. A and D.

	°	″
1910·690	256·8	32·18

A and E.

	°	″
1910·690	75·8	36·38

10075 Hu 585

	°	″
1910·572	48·8	4·31
·690	49·8	4·51
·701	51·5	4·73
·739	50·3	4·65
1910·676	50·1	4·55

10898 β 1140

	°	″
1910·627	270·0	3·93

10917 H 281

	°	″
1910·580	334·7	13·39
·701	334·3	13·63
·706	336·6	13·72
1910·662	335·2	13·58

10925 Σ 2790

	°	″
1910·660	43·0	4·37
·690	45·2	4·38
1910·675	44·1	4·38

10934 Holmes

	°	″
1910·627	246·1	12·91
·660	244·0	12·51
·668	245·4	12·51
1910·652	245·2	12·64

10943 S 788

	°	″
1910·627	87·7	44·18
·668	89·2	44·31
·796	88·3	44·91
1910·697	88·4	44·47

11021 Espin 100.

	°	″
1910·627	159·7	3·72
·701	159·5	4·06
·739	159·1	3·89
1910·689	159·4	3·89

11037 H 3033

	°	″
1910·796	244·0	24·77
·930	243·5	23·88
1910·863	243·8	24·33

11048 A. G. 272

	°	″
1910·690	184·9	3·93
·701	185·8	3·92
1910·696	185·4	3·93

11487 H 1722

	°	″
1910·701	47·0	17·36
·739	46·5	17·14
1910·720	46·8	17·25

11499 β 697

	°	″
1910·668	94·1	....
·690	93·7	18·95
1910·679	93·9	18·95

11546 A. G. 280

	°	″
1910·745	179·6	11·18

11601 A. G. 281

	°	″
1910·745	22·1	2·56
·796	20·0	2·69
·930	20·0	2·56
1910·824	20·7	2·60

12193 H 3174

	°	″
1910·796	18·4	5·84
·930	19·7	5·68
1910·863	19·1	5·76

12222 H 3176

	°	″
1910·791	164·0	26·07
·796	164·1	26·14
·816	164·4	26·35
1910·801	164·2	26·19

12230 Σ 2991 rej.

	°	″
1910·668	359·2	32·82

12345 β 854

	°	″
1910·791	87·5	....
·796	87·7	2·51
·816	89·2	2·57
1910·801	88·1	2·54

12753 Kr. 67

	°	″
1910·815	160·7	3·14

Occultations of Stars by the Moon.

Date.	Star.	Phenomenon.	Limb.	G. M. Time of Observation.
1910				h m s
August 29..........	40 Geminorum	Disappearance	Bright	19 34 13·2
"	"	Reappearance	Dark	20 24 48·4
September 29.......	46 Leonis.........	Disappearance	Bright	21 21 49·6
"	"	Reappearance	Dark	22 17 56·3
December 10........	54 B Ceti.........	Disappearance	Dark	12 42 01·7
1911				
January 16..........	7 Leonis..........	Disappearance	Bright	16 17 12·5

Halley's Comet.

A search for this famous comet was begun here in July, 1909, the 8-in. photographic doublet being used. During the latter part of July, August and September, exposures were made whenever the telescope was available and the weather clear. The plates were on too small a scale, however, and the discovery was made photographically by Prof. Wolfe of Heidelburg, on Sept. 11, 1909. The comet was first seen here on November 9 with the 15-inch equatorial, the estimated magnitude being about 13. The following observing notes do not furnish a very complete history of the comet owing to the unusually cloudy weather:

1909, Nov. 23—Estimated magnitude 12.5; centre rather star-like.

Nov. 30—Estimated magnitude 12.5; much the same as on Nov. 23.

Dec. 11—Estimated magnitude 12.

Dec. 16—Same as on Dec. 11—Diameter 15″.

1910, Jan. 4—Exposed two hours with Σ plates; no sign of a tail on the negative but side of comet towards the sun was more sharply defined than the opposite side.

Feb. 10—Exposed 1^h 40^m: tail of $\frac{1}{2}°$ showing on negative. Comet quite easily seen in field glasses of power 8.

Feb. 24—Much the same as on Feb. 10.

April 12—First morning observation—Very decided nucleus 6″ or 7″ in diameter—Not visible to naked eye.

April 14—Comet seemed brighter than on April 12, but sky was hazy.

April 21—Observed comet through haze.

April 27—Saw comet with naked eye, 1° of tail being clearly visible—about 3° visible in field glass.

April 30—Magnitude 3.0—Nucleus very star-like—3° of tail visible to eye.

May 3—Magnitude about 3.0—About 8° of tail visible to eye.

May 5—About same brightness—10° of tail visible to eye and quite uniform.

May 9—20° of tail visible to eye.

May 14—Tail over 35° long.

May 15—Tail visible at 13^h 30^m (E.S.T.) and head visible at 15^h 30^m (E.S.T.). Tail about 50° long.

May 16—Tail seemed to extend up to the Milky Way.

May 18 and 19 were unfortunately cloudy.

May 21—Comet visible in western sky—Tail about 15°

May 22—Nucleus brighter than on 21st.

May 26—Tail about 40°—Very sharp nucleus.

May 27—Tail about 50°.

May 28—Had best view of comet—Tail about the same as last night.

June 3—Tail about 15°—Nucleus much smaller.

June 4—Tail about 12°—Magnitude about 7.5.

June 8—Tail about 6°—Nucleus not nearly so sharp as on June 4.

June 9—Tail about 6°.

June 10—Comet very faint owing to haze.

June 28—Magnitude about 8.5.

TABLE OF EXPOSURES

Plate.	Date.	Exposure. Beginning.	Exposure. Duration.	Camera*.
	1910	h m	h m	
1	May 3	20 00	0 37	O
2	May 5	19 48	0 36	O
3	May 9	20 2	0 20	O
a 4	May 27	15 23	0 44	O
a 5	May 27	15 23	0 44	N
a 6	May 28	14 10	1 00	O
a 7	May 28	14 10	1 00	N
a 8	June 3	14 30	1 32	O
a 9	June 3	14 30	1 32	N
*a*10	June 4	14 32	1 28	O
11	June 4	14 32	1 28	N
12	June 8	14 38	1 17	O
13	June 8	14 38	1 17	N
14	June 9	14 35	1 16	O
15	June 9	14 35	1 16	N

* O refers to the 8-inch Brashear Doublet which gives a field of about 11° on an 8 x 10 plate.

* N refers to a Zeiss lens which gives a field of about 40° on an 8 x 10 plate. This lens has a speed of $f3{\cdot}5$.

a See Plates.

POSITION OBSERVATIONS OF HALLEY'S COMET.

G.M.T. 1909.	No. of Comparisons	Δα	Δδ	α (apparent)	δ (apparent)	log p. Δ α	log p. Δ δ	Star
h. m. s.		m. s.	′ ″	h. m. s.	° ′ ″			
Nov. 30... 15 56 24	8-8	−1 3·04	−2 4·9	4 29 21·85	15 55 35·0	0·187*n*	0·638	1
Dec. 11... 13 2 4	8-8	−0 53.12	+3 15·9	3 43 2·31	14 45 27·7	0·567*n*	0·676	2
Dec. 16... 20 8 18	8-8	−0 1·95	+4 49·7	3 19 29·16	14 00 3·5	0·803	0·766	4
1910								
Feb. 24... 12 29 18	8-8	−0 47·98	−11 30·1	0 37 34·88	7 53 12·5	0·785	0.777	5

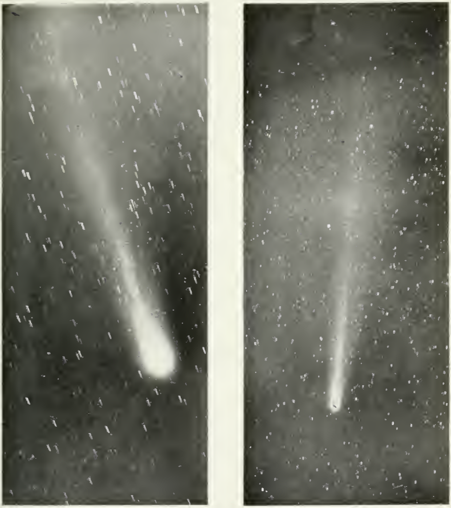
MEAN PLACES FOR 1909-10 OF COMPARISON STARS.

Star.	α	Reduction to Apparent.	δ	Reduction to Apparent.	Authority.
	h. m. s.	s.	° ′ ″	″	
1	4 30 21·50	+3·39	15 57 29·4	+10·5	A. G. 1231.
2	3 43 51·56	+3·87	14 41 58·7	+13·1	A. G. 1108.
3	3 20 21·10	....	13 46 1·9	....	A. G. 1004.
4	3 19 27·85	+3·26	13 54 59·5	+14·3	B. D. 13°.542. Micrometer comparison with (3).
5	0 38 24·35	−1·85	8 4 50·1	− 7·5	A. G. 232.

No. 4.

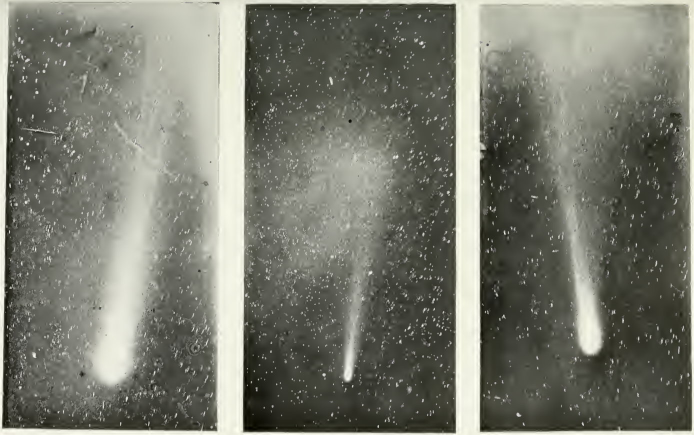
No. 5.

Fig. 17.—Photographs of Halley's Comet.



No. 6. No. 7.

Fig. 18.—Photographs of Halley's Comet.



No. 8. No. 9. No. 10.

Fig. 19.—Photographs of Halley's Comet.

APPENDIX 3.

REPORT OF THE CHIEF ASTRONOMER, 1911.

MERIDIAN WORK AND TIME SERVICE

BY

R. M. STEWART, M.A.

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TABLES

APPENDIX 3.

MERIDIAN WORK AND TIME SERVICE, BY R. M. STEWART, M.A.

OTTAWA, CANADA, April 1st, 1911.

DR. W. F. KING, C.M.G.,
Chief Astronomer,
Dept. of Interior,
Ottawa.

SIR,—I have the honour to report as follows on the work carried out under my charge during the fiscal year ending March 31, 1911.

Regular observations with the meridian circle for the measurement of right ascensions were begun in March, 1910. A description of observing list, methods of observation and reduction, and the results of the observations obtained up to the close of the calendar year 1910 will be found below. The observers were Mr. D. B. Nugent and myself.

During the course of the year several alterations to the instrument, which were necessary for the successful prosecution of zenith distance work, were carried out; it was found possible to begin preliminary work in this co-ordinate in January, 1911. Several pieces of work still remain to be done before the instrument will be in first-class working order; progress on these has been extremely slow; apparently the workshop is so overcrowded that it is barely possible to keep abreast of the urgently needed requirements of the moment, no time being left for the overhauling and improvement of instruments.

As it is more convenient to treat the observations of a whole calendar year together, the discussion of the meridian circle observations terminates with the calendar year, 1910.

Observations were made to determine the latitude and longitude of nine stations, the most important of these being Winnipeg, whose longitude was determined from Ottawa with considerable care. The field observations were made by Messrs. McDiarmid and Jaques. Several series of personal equation observations were made, which are discussed in detail below.

The time-service has been maintained as in the past without important change; most of the work in connection with the up-town service has been done, as in previous years, by Mr. D. Robertson. A statement of the number of clocks in operation will be found below.

THE MERIDIAN CIRCLE.

The piers for the two azimuth marks have been erected, and those parts of the apparatus not yet obtained have been ordered. Several alterations required in the meridian circle to fit it for zenith distance work have been completed, and regular work both in right ascension and zenith distance has been begun, the former

in March, 1910, the latter in January, 1911. The observing list in right ascension consisted of stars from Newcomb's Fundamental Catalogue north of 10° declination together with a number of selected stars between 70° and 80°; the star-list of the Berlin Jahrbuch was taken as fundamental. Besides systematic differences, there are occasional large discrepancies between the positions of individual stars as given in the two catalogues; an extreme case of this is given by the star ω Herculis, where the difference amounts to .18 sec.; in this case Newcomb's position is undoubtedly wrong, the proper motion having been apparently taken with the wrong sign. It was desired to investigate these differences, as well as to establish a somewhat more extended star-list for use in longitude work. These observations, comprising 5018 transits, with their reduction to mean place, are given below. There were in addition observations on a number of other nights, which for various reasons have been rejected.

With the beginning of zenith distance work in January a more extensive observing list was undertaken. For a number of years a great need has been felt for an extended list of declinations for latitude work, depending on observations of recent date, and it is hoped that these observations may to a certain extent fill that requirement. The observing list comprises those stars which have been used in latitude determinations by this observatory within recent years; the list will be enlarged from time to time as required, by the addition of stars being actually used in the field work.

This report, however, so far as a detailed discussion of the observations is concerned, deals only with the calendar year 1910.

Azimuth Marks.—The piers for the azimuth marks were built during the summer of 1910. Like the other piers, they are constructed of concrete, and in general form are similar to the south collimator pier. The northern part of each pier is penetrated by a pit to allow access to the underground lens which serves as the fixed mark; this part terminates about two and a half feet below the top of the pier proper. Through the centre of the latter is a vertical shaft about eight inches in diameter, extending down to the level of the bottom of the pit, into which it opens by a small arch; at the bottom of the arch the underground lens will be fastened to the footings of the pier.

Provision has been made for the thorough drainage of both piers; each is surrounded by broken stone to about the level of the ground, and the footings are surrounded by a tile drain. In the case of the north pier this is led to a pit dug in the gravelly soil a short distance away, there being sufficient slope to the ground in the immediate vicinity to ensure natural drainage from this point. The drainage of the south pier is effected by means of a cistern built immediately underneath that part of the pier which contains the pit for access to the underground mark; this cistern is connected by a pipe to the same power-pump which is used in connection with the cistern underneath the transit house.

In the absence of provision for the immediate erection of the permanent stone buildings to shelter the piers, temporary wooden shelters were erected, which, though rather unsightly structures, serve the present purpose fairly well. Electric wires have been provided to each shelter to furnish illumination for the marks; this is controlled from the meridian circle room.

Upon the completion of the piers the focal lengths required for the underground lenses were measured and the lenses were ordered. The two six-inch collimating lenses for the azimuth marks, and the two three-inch lenses to serve as underground reference marks for these, were received during the course of the year. Mountings for all six lenses, as well as for the azimuth marks, were ordered.

Each of the long-focus collimating lenses is to be mounted on a slide capable of motion by a micrometer screw in the plane of the prime vertical; on the same slide will be a mark consisting of a platinum wire parallel to the meridian, and also another mark consisting of two parallel platinum wires to be viewed by an eye-piece. The point midway between these marks, which approximately coincides with the centre of the collimating lens, will be in the primary focus of the underground lens serving as reference mark; by the use of a mercury basin underneath the latter, the same point in the collimating lens can be at any time set vertically over the optical centre of the underground lens. A similar arrangement holds in the case of the azimuth marks.

On account of the small angle of dip of the lines of sight to the azimuth marks (one or two degrees), it will be impossible to use the ordinary horizontal collimators, which would interfere with the long-focus lenses. It is hoped that eventually the azimuth marks themselves may be used as collimators, the angle between them being checked up from time to time by reversal of the telescope. Provision has, however, been made for mounting the north collimator directly opposing the south azimuth mark, the two to be used in the same way as the ordinary collimators if desired. Mountings for this purpose have been ordered.

The Observing Room.—Considerable difficulty has been experienced with the temperature of the observing room. The walls of the building are of stone, and the roof of concrete; inside these is a sheeting of galvanized iron, an air-space of a few inches being left next the walls, and of about a foot beneath the roof; a number of louvres are provided to allow circulation of air in this space. Owing to the absorption of heat by the walls and roof during the day, it was found that the temperature within the room did not follow the outside temperature at all satisfactorily, even with the roof shutters open. The effect of this on observations of right ascension would probably be limited mainly to increased unsteadiness of star-images, but in declination observations it would probably introduce serious anomalies of refraction. Two sixteen-inch ventilating fans have been placed in the walls of the room, in the hope that enough outside air might thus be circulated to at least partially remove the difficulty; though these were of some assistance they did not entirely remove the temperature difference. It is proposed to remove the sheet iron covering inside the louvres and replace it by doors which can be left open or closed as desired; this will at least allow a freer circulation of air, which should alleviate the difficulty.

Thermometers and Barometers.—A thermograph has been mounted in a louvred shelter a short distance to the southwest of the transit annex; from the records of this instrument are obtained the temperatures for use in the computations of refraction. To determine its error several comparisons are made, during the course of an evening's observations, with a mercury thermometer mounted beside it. Incidentally it was found that considerable differences of temperature existed between the position of this shelter and that of the one used for the platinum resistance thermometer of the Callendar Recorder, which is situated north of the transit annex. These differences were frequently irregular during the day, as was to be expected under varying conditions of wind and sunshine; during the night, however, they were more regular, the fall of temperature of the northern one being apparently retarded by radiation from the adjacent pinery.

Barometric heights are read from the standard barometer (by Casella) in the Time Room; in case of irregular variations interpolations are made with the assistance of the records of an adjacent barograph.

Instrumental Changes.—As mentioned in my last report, the original mountings of the microscopes were not sufficiently rigid. The microscopes were mounted,

not on a continuous ring, but on separate arms extending radially from the standards; slight distortions of these arms, presumably induced by temperature changes, were sufficient to render the nadir decidedly unstable. In order to stiffen them as much as possible, two cast-iron rings were made and carefully fitted to the inner ends of the microscope carriers, thus connecting together each set of four microscopes. Unfortunately the construction of the standards rendered it impossible to make these rings in the form of complete circles, the greatest length attainable being 270°; this no doubt causes the stiffness of the mounting to be very much less than it otherwise would have been. However, the addition of the rings has very materially increased the stability of the microscopes; for ordinary differential work the arrangement will probably be quite satisfactory.

A new mercury basin of amalgamated copper was made to replace the old one, which was not amalgamated; a considerable improvement in the average steadiness of the reflected images has resulted, though at times, especially in winter evenings with rapidly falling temperature, the definition is not very good.

An eye-piece with a reversing prism attachment (power 200) was obtained in June, and has since been regularly used for measurement of collimation and for observations of several stars each night. Eye-pieces of higher power were also obtained for the circle microscopes.

Observations.—Regular observations with the meridian circle were begun in March, 1910; throughout the remainder of the year 1910 it was used as a transit instrument. The observing list comprised most of the stars in Newcomb's Fundamental Catalogue north of 10° declination; a selected list of stars between 70° and 80° declination was also added, in order to provide a greater number of azimuth stars for use in longitude work. In the past the star-places of the Berlin Jahrbuch have been used for longitude work almost exclusively; besides systematic differences, there are occasional fairly large discrepancies between star-places as given in the two catalogues mentioned; it was desired both to investigate these, and to render the remainder of the Newcomb stars, some of whose positions are quite poorly determined, available for use in longitude work.

The Berlin Jahrbuch stars between 10° and 45° declination (as far north as the zenith) were taken as clock-stars; the azimuth stars included all those north of 80° declination whose places were given in any one of the four principal ephemerides, the Berlin Jahrbuch places being given the preference. Observations for level and collimation were made as a rule both before and after the evening's star-observations. After the arrival of the reversing eye-piece it was used for all observations both of stars and collimation; for the latter, half the pointings were made with apparent motion of the wires towards the micrometer head for increasing readings, and half in the opposite direction; in the case of stars, the great mass of the observations were made with the apparent direction of motion normal; each night, however, several stars were observed with the apparent direction of motion reversed; the stars so observed were as far as possible grouped in pairs, each star of a pair having approximately the same declination; usually one star of a pair was observed with eye-piece normal, the other with eye-piece reversed; on the following night the first star was observed with eye-piece reversed, the second with eye-piece normal. In this way sufficient data were accumulated for a fairly rigorous determination of bisection-error for each observer. In the case of the azimuth stars the procedure was somewhat different; one half the observation of each star was made with eye-piece normal, the other half with eye-piece reversed; in this case the error of bisection is entirely eliminated from the complete observation.

Collimation and Level.—The south collimator contained one horizontal and two vertical wires, the vertical wires being separated by about 9″; in the north

collimator there were two pairs of wires at right angles, one pair being separated by about 14″, the other pair by about 17″; during a part of the year one of these pairs was set vertical and used for collimation readings, during the remainder the other pair was used. A complete reading for collimation was taken by setting the south collimator on the north ten times, the micrometer head being left at the mean of the ten pointings; the telescope micrometer was then set eight or ten times on each of the collimators. Pointings of the south collimator on the north were made by setting the two vertical wires of the former symmetrically between those of the latter; pointings of the telescope on either collimator were made separately on each collimator wire, by placing the right ascension wires of the telescope (distance about 4″) symmetrically on each side of the collimator wire. The same eye-piece was used for all pointings, giving with the meridian circle a power of about 200, and with the collimator about 130. Beginning with June 23 a reversing prism was attached to the eye-piece, and an equal number of pointings was made in each case with the apparent direction of motion normal and reversed.

The effect of a constant error of setting (to right or left) of the kind eliminated by the reversing prism would appear in the pointings of the telescope on either the north or the south collimator, but would be eliminated from the mean; in the setting of one collimator on the other, however, the error would persist, and would enter the final value of collimation, unless a reversing prism were used. To find what this error (which we may call bisection-error) amounted to, the separate pointings were examined and grouped so as to show the effect, in the case of both the observers engaged. It was found that in setting the telescope on the collimator wires, S* set on the average .03″ too far to the left, N† .02″ in the same direction. All the collimator wires not being quite equal in apparent diameter, the pointings on each wire were grouped separately; it appeared that for the largest wires, whose images more nearly filled the space between the telescope wires, the bisection error was slightly smaller; the evidence was, however, not very conclusive on this point. In the case of pointings of one collimator upon the other, it was found that S was influenced decidedly by the distance between the wires set upon; when the wires 17″ apart were used in the north collimator he set .13″ to the right; with the wires 14″ apart the error was .03″ in the same direction. The observations made by N with the reversing prism were upon the more widely spaced wires only; his error of setting was .09″ to the left. In observations taken after June 23 these errors are all eliminated; in those made prior to that date, without the reversing prism, they were presumably present; no correction has, however, been introduced to allow for them; their effect on differential observations would be practically negligible.

For measurements of instrumental level a mercury trough was used, in conjunction with a Bohnenberger eye-piece of the usual form; by means of slightly oblique illumination the reflected images of the wires were made to appear bright in a dark field; settings were made by obliterating the bright reflected images of the micrometer wires by the wires themselves; to eliminate any errors arising from the obliquity of the illumination the wires were successively illuminated from each side, an equal number of pointings being taken in each case. On account of the fact that the phenomenon watched for is not a coincidence of wires, but simply the position of minimum brightness, there appears to be no room in this observation for a personal effect such as might conceivably enter in the ordinary nadir observation.

Readings of collimation and level were taken in general both before and after an evening's observations, and occasionally at other times. The observed micrometer readings for collimation line and for vertical line are given in Table II., as well

* R. M. Stewart.
† D. B. Nugent.

as the adopted values of collimation and level error, in seconds of time, for those nights on which star-observations were also obtained. In deriving the latter it is to be noted that the micrometer head is on the side next the clamp, and that the micrometer readings increase as the wires move towards the head; the adopted value of one revolution of the micrometer screw was 3.216 sec. Hence if C be the micrometer reading for the collimation line, L for the vertical line, and M for the mean of the contacts on the micrometer head, we have for Clamp East $c = (C-M) \times 3.216$, $b = (C-L) \times 3.216$, and for Clamp West $c = (M-C) \times 3.216$, $b = (L-C) \times 3.216$. The following were the adopted values of M throughout the year; the contact strip was broken about 9^h on March 28, and was replaced by a new one; it was re-adjusted on May 13:—

	r
March 11—March 28, 9^h	9·5880
March 28, 9^h—May 13	9·6006
May 14—Dec. 31	9·6600

It was noticed that the differences between observed values of collimation line before and after an evening's observations were apparently somewhat systematic, the later micrometer reading being quite usually the larger. To investigate this point, the observations for the whole year were grouped in several different ways, the results for the two clamps being treated separately.

Below is a list of the changes arranged chronologically, each period being the interval between successive reversals of the telescope; ΔC is the change in observed micrometer reading for line of collimation during the evening, the positive sign indicating that the later reading was the greater:—

Date.	Clamp.	Average ΔC.	No of nights.
		r	
March 17—April 2	W	·0034	5
April 3—21	E	·0003	9
April 22—May 15	W	·0055	13
May 16—21	E	·0032	4
May 26—June 9	W	·0042	8
June 10—15	E	·0021	3
June 18—25	W	·0038	4
June 28—July 19	E	·0006	9
July 26—August 12	W	·0023	7
August 18—September 15	E	·0004	14
Sept. 16—October 11	W	·0040	13
Oct. 12—November 9	E	—·0005	9
Nov. 27—December 25	W	·0050	5
Mean	W	·0042	55
"	E	·0006	48

From the above table there would appear to be no doubt that on the average there was a small systematic change in collimation during the evening. This is probably not unusual, but there is no apparent reason or explanation for the fact that the change is so much greater in the position Clamp W. than in Clamp E.; that this is not accidental is shown by the fact that the value given for "average ΔC" is in every case less for Clamp E. than either of the adjoining values for Clamp W.

The observations were next grouped as below to investigate the effect of change of temperature during the evening, which seemed the most plausible cause of a change in collimation; Δt denotes the drop in temperature in the observing room between the two readings:—

Clamp West.			Clamp East		
Average Δt	Average ΔC	No. of nights.	Average Δt	Average ΔC	No. of nights.
6·9°C	r ·0037	4	6·3°C	r ·0012	4
5·3	·0053	5	5·3	−·0010	5
4·4	·0055	10	4·5	·0013	12
3·5	·0038	17	3·6	·0013	13
2·5	·0037	8	2·6	−·0008	5
1·1	·0048	5	0·9	·0014	8

It is fairly evident that change of temperature has no effect on the collimation line; a comparison of the values of ΔC for Clamp W. and Clamp E. offers strong confirmatory evidence that the difference between the effects in the two positions of the instrument is real; in every case the value for Clamp E. is decidedly less than the corresponding one for Clamp W.

Grouping the observations again according to the time elapsed between the successive readings we have the following, ΔT denoting the time interval:—

Clamp West.			Clamp East.		
Average ΔT	Average ΔC.	No. of nights.	Average ΔT	Average ΔC	No. of nights.
h. m. 5 18	r ·0049	10	h. m. 5 12	r ·0013	5
4 38	·0065	6	4 40	·0020	10
4 10	·0037	13	4 13	·0006	5
3 39	·0031	11	3 38	·0010	10
3 13	·0037	9	3 04	−·0017	8
2 32	·0049	6	2 32	·0003	10

There is thus no dependence of change of collimation on the time elapsed between readings; or rather, the maximum change takes place within less than $2\frac{1}{2}$ hours after the instrument has been in use; and again the difference between Clamp W. and Clamp E. shows up in every case.

For the sake of completeness, still another grouping was made, dependent on the average temperature during the interval between collimation readings; the result was practically identical with those given above, no effect on the average value of ΔC being visible.

The same process was repeated with respect to the changes in measured level error; the chronological tabulation is given below, Δb denoting the change in level error; *i.e.*, $\Delta b = \Delta\ (C-L)$ for Clamp E., and $= \Delta\ (L-C)$ for Clamp W.

Date.	Clamp.	Average Δb.	No. of nights.
		r	
March 17—April 2	*W*	—·0031	5
April 3—21	*E*	—·0033	9
April 22—May 15	*W*	—·0036	13
May 16—21	*E*	—·0010	4
May 26—June 9	*W*	—·0002	8
June 10—15	*E*	·0004	3
June 18—25	*W*	·0007	4
June 28—July 19	*E*	·0020	9
July 26—August 12	*W*	·0000	7
Aug. 18—Sept. 15	*E*	·0016	14
Sept. 16—Oct. 11	*W*	·0015	13
Oct. 12—Nov. 9	*E*	·0004	9
Nov. 27—Dec. 21	*W*	—·0013	4
Mean	*W*	—·0009	54
"	*E*	·0002	48
Mean	both Clamps	—·0003	102

There is, as was to be expected, a seasonal effect in evidence here, the western pivot showing a tendency to sink throughout the evening during the months of March, April, May and December, and to rise in the same period throughout the intervening months; the average for the year is practically negligible, nor is there any evident difference in the behaviour of the instrument in Clamp W. and Clamp E.

The last two facts mentioned afford independent evidence of the strongest kind as to the reality of the systematic change in collimation in Clamp W., and the practical absence of such a change in Clamp E. For since the average value of $\Delta b\ (= \Delta\ \overline{C \sim L})$ is practically zero in both positions of the instrument, it follows that if the observed values of ΔL had been tabulated they would have exhibited the same peculiarities as ΔC; that is, measurements of the two entirely independent quantities, collimation line and vertical line, show the same systematic peculiarities; which proves that the change considered is a collimation effect. It is difficult to understand, however, why the effect should be different in the two positions of the instrument; upon this point further light must be awaited. In the meantime, it is not of very great moment so long as only differential observations are considered.

Pivot Errors.—As no rigorous determination had been made of pivot errors, it was assumed that only relative ellipticity of pivots was present. The value adopted for this was that obtained previously in the series of observations for measuring the flexure of the axis.* According to the notation used then, the horizontal component

* Report of the Chief Astronomer, 1910, p 406.

of pivot error introduced by ellipticity may be represented by an expression of the form $\alpha \sin 2\ (\theta - \chi)$, where θ and $\theta - \chi$ represent respectively, for Clamp East, the southern zenith distance of the telescope and of the major axis of the (relative) ellipse, a positive value denoting an increase in the instrumental azimuth; the vertical component of pivot error arising from this cause is negligible. Resolving this quantity along the collimation line of the telescope, and expressing it as a correction to the observed collimation, we have for Clamp East:

$$\Delta c = \alpha \sin 2\ (\theta - \chi) \sin \theta$$
$$= \tfrac{1}{2}\, \alpha\, [\cos (\theta - 2\,\chi) - \cos (3\,\theta - 2\,\chi)];$$

or putting $\theta = 45^\circ\, 24' - \delta$, and adopting the values $\alpha = .36'' = .024$ sec., $\chi = 96^\circ\, 30'$,

$$\Delta c = .012\, [\cos (\delta + 147^\circ\, 36') - \cos (3\,\delta + 56^\circ\, 48')].$$

Similarly, for Clamp West,

$$\Delta c = -\ .012\, [\cos (\delta + 121^\circ\, 36') - \cos (3\,\delta + 30^\circ\, 48')].$$

These values were tabulated and used for correcting all the observations.

Bisection Error.—As stated above, observations of several stars were usually made on each night with the apparent direction of motion reversed by means of a reversing prism. During the summer a preliminary computation of bisection error was made from such observations as were then available, in order to form a basis for proceeding with the regular computations. It was found that the observer N had no appreciable error of bisection, but that S consistently set the micrometer wires too far to the left by about .023 sec. equatorial interval. This value was therefore adopted for his observations, while those of N were left uncorrected.

From a thorough discussion of all the material available at the end of the year, made by Mr. Nugent, it was found that for stars up to 80° declination the error of bisection for S was .026 sec. equatorial interval, while for azimuth stars above 80° it was apparently less. No effect could be found depending on the declination or the magnitude of the stars observed. The bisection error of N again came out practically zero. An account of this investigation is given by Mr. Nugent in Appendix A to this report.

It is to be noted that the correction required for an error of this kind is a constant correction to the observed collimation, changing sign at the zenith. The sign of the correction is of course to be changed for such observations as were made with the apparent direction of motion reversed, and it is not to be applied at all to observations which were made half normal and half reversed.

Reduction of Observations.—In the tables headed "Reduction of Transits Observed" are given the quantities necessary for the computation of each separate observation of right ascension. The first column contains the date, the second a number for reference in the notes, the third the name of the star observed, the Berlin Jahrbuch numbers being used for stars contained in that catalogue. In the fourth column L. C. denotes that the star was observed at lower culmination; *r* denotes that the apparent direction of motion was reversed by the use of the reversing eye-piece; *n r* denotes that the apparent direction of motion for the first and last quarters of the transit was normal, for the middle half reversed; *r n* denotes the converse of this. The fifth column contains the initial denoting the observer, the sixth the mean of the clock-times of the different contacts recorded by the registering micrometer on the chronograph.

Of the quantities in the seventh column, the upper, unbracketed one is the measured value of collimation, taken from Table II.; the quantity immediately

underneath this, enclosed in brackets, is the value of the polar deviation of the instrument, as derived from the observations. To the values of collimation given, the following corrections were applied in the computation:

(1) diurnal aberration, $-.015$ sec.

(2) the correction for one-half the width of the contact strip on the registering micrometer; the adopted values for this are as follows:—

March 17—March 26	·014 sec.
April 2—May 12	·013 "
May 15—Dec. 21	·018 "

The total correction for this effect is always positive; hence the correction to be applied to the collimation is positive for stars at upper culmination and negative for those observed below the pole.

(3) ellipticity of pivots; this correction was derived from the formulae given above.

(4) personal error of bisection; for observations by N no correction was applied; for unmarked observations by S a correction of $+.023$ sec. was applied in the case of stars observed facing south, and of $-.023$ sec. for stars observed facing north; in all observations except a few mentioned in the notes, this division line corresponds to the zenith; for those observations by S which are marked *r* the same correction was applied with the opposite sign; for observations marked *n r* or *r n* no correction was applied.

The values of *n*, the polar deviation of the instrument, were computed as follows:—The correction for collimation, including the above supplementary corrections, having been first applied to each observed time of transit, we have for each star an equation of the form

$$\Delta\ T + m + n \tan \delta = \alpha - T,$$

where the letters involved have their usual significance, δ being measured through the pole in the case of stars observed at lower culmination. The mean of these equations was taken, for each night, for all stars between 30° and 60° declination whose places are given in the Berlin Jahrbuch; by combining this mean equation with each of those derived from observations of azimuth stars on the same night, as many values of *n* were obtained as there were azimuth stars observed on that night; the mean of these values of *n* was adopted for the night. As the clock rate was always small, no correction was applied for this in the computations of *n*.

The eighth column of the tables contains the seconds of the time of transit, corrected for both collimation and polar deviation; the ninth contains the seconds of tabular apparent right ascension for the date, of all Berlin Jahrbuch stars up to 60° declination, and of all azimuth stars. The tenth column is the difference between the eighth and ninth, exhibiting the value, derived from the observation, for the quantity $\Delta\ T + m$; it is entered only for clock stars and azimuth stars, the former comprising all Berlin Jahrbuch stars culminating south of the zenith.

In deducing the value of "adopted $\Delta\ T + m$" given in the eleventh column two corrections were employed, one for clock-rate, the other depending on the declination of the separate stars from which the apparent values of this quantity are deduced in the preceding column. From a preliminary examination of the observations, it was suspected that there was a systematic effect depending on the declination of the stars observed; a thorough investigation of this point was therefore made for the range of declination covered by the clock stars, viz., 10° to 45°.

The observed values of $\Delta T + m$, as given in the tenth column, were grouped for each night into zones covering 5° of declination, and the mean taken for each zone. The mean of the three zones, 30° to 35°, 35° to 40°, 40° to 45°, was taken as a standard of comparison for each night, since stars were observed in each of these zones on almost every night. The differences between this standard and the means for the different zones were then taken, and tabulated with appropriate weights. This was done separately for each of the observers engaged, and for each position of the instrument. The weighted means of the differences are given below, in the sense of a correction to reduce $\Delta T + m$ for each zone to the mean of the three zones taken as standard:—

	Clamp W.		Clamp E.	
	S	*N*	*S*	*N*
10°—15°	·015	·020	·016	·024
15°—20°	·022	·007	·036	·018
20°—25°	·005	·014	·018	·025
25°—30°	·007	·014	·021	·012
30°—35°	·005	·001	·007	·001
35°—40°	·009	·006	·003	·015
40°—45°	—·012	—·008	—·007	—·015

From a careful examination of this table, no systematic effect dependent on the clamp or on the observer appeared to exist; weighted means were therefore taken for each zone as a whole, giving the following system of corrections, each with its appropriate weight:—

Zone.	Correction.	Weight.
10°—15°	·019	97
15°—20°	·017	121
20°—25°	·016	81
25°—30°	·013	129
30°—35°	·003	274
35°—40°	·008	333
40°—45°	—·011	365

These corrections appear to fall naturally into the three groups 0° to 30°, 30° to 40°, 40° to 45°, the separate groups having the following corrections:—

Zone.	Correction.
10°—30°	·016
30°—40°	·006
40°—45°	—·011

Having obtained these differences, it is evidently immaterial which zone is taken as standard; if we adopt the zone 10° to 30°, the above differences become, neglecting the third place of decimals:

Zone.	Correction.
10°–30°	·00 sec.
30°–40°	–·01 "
40°–45°	–·03 "

These were adopted as the definitive corrections to the quantity $\Delta T + m$. It may be remarked here, that if the clock stars observed had each night been uniformly distributed in declination, no effect would result from the application of such corrections except the addition of a constant to the observed right ascensions; since this was not the case, it is necessary to apply the above corrections in order that the right ascensions observed on different nights may be referred to the same zone of fundamental stars, as nearly as may be; this zone is in the present instance 10° to 30°. In view of the sudden change indicated in the correction between the zones 30° to 40° and 40° to 45°, a careful examination was made to decide whether or not it occurred exactly at 40°; this was found to be the case, as nearly as could be determined. The cause of these differences might conceivably lie either in errors in the tabular places of the stars, or in some systematic instrumental effect such as flexure. In the absence of strong evidence to the contrary the presumption would of course be strongly in favor of the latter hypothesis; though in that event it is difficult to understand why the results in the two positions of the instrument should agree as closely as they do.

After the application of the above systematic corrections to the separate observed values of $\Delta T + m$, the mean of the latter was taken for each night's observations, thus giving a value for $\Delta T + m$ for the mean epoch of the observations. For the computation of clock-rates, the above mean values were diminished in each case by the quantity m, as deduced from the ordinary formula $m = b \sec \varphi - n \tan \varphi$, φ being the latitude* and b and n the level error and the polar deviation respectively. The resulting values of ΔT were tabulated for the whole year, and by combining successive determinations by the same observer in the same position of the instrument, a series of clock-rates was obtained for as many epochs as possible. Where these showed continuity over a considerable period, as was the case for the greater part of the year, a formula was derived by least squares on the assumption that the clock-rate changed uniformly during the period considered; the values resulting from the formula were then compared with the observed values, and where they showed reasonable agreement the former were adopted. The adopted values of daily rate in seconds for the period covered by the observations are as follows, T being reckoned in days:—

Mar. 17—Apr. 14	Zero
Apr. 21—Aug. 8	·0882+·0004 (T—June 17)
Aug. 11—Sep. 2	·2614+·0087 (T—Aug. 23)
Sep. 7—Sep. 10	·300
Sep. 13—Sep. 26	–·164
Sep. 27—Sep. 30	Zero
Oct. 3	·120
Oct. 7—Nov. 9	·370+·0027 (T—Oct. 23)
Nov. 20—Nov. 27	–·052
Dec. 5—Dec. 12	·720
Dec. 21	·180

The adopted values of $\Delta T + m$, including the effect of clock-rate, are given in the eleventh column. Where a clock-rate other than zero was adopted, both the value of $\Delta T + m$ for the mean epoch of the observations, and the adopted hourly rate, are given in the notes.

* $\varphi = 45° 23' 38''$

The twelfth and last column of the tables, which is formed by the addition of the eighth and eleventh columns, gives the deduced apparent right ascension for the date, of all except the azimuth stars.

Ledgers of Mean R.A. 1910.0—In the tables with this heading the observations on each star, reduced to mean place for the beginning of the fictitious year, are arranged chronologically, the date, clamp and observer being noted for each observation. The reductions to mean place were effected in the following way. For all stars whose apparent places are given in the Berlin Jahrbuch, the Star-List of the American Ephemeris, or the Nautical Almanac, the difference between the tabular apparent place for the date and the tabular mean place (taken to the nearest second decimal place) was applied; since in these ephemerides the mean right ascensions are given to three decimal places, and the third place used in the computations for apparent right ascension, though in the latter only two decimal places are retained, there remains a further correction necessary in the third decimal place, depending on the third decimal place of the tabular mean right ascension; this has been applied as the correction Δ_1 to the mean of the observed positions. The same applies to stars bracketed in the Berlin Jahrbuch, which do not occur in the other ephemerides, since for these stars the apparent places were computed in conformity with the usage of that catalogue. In the case of a few additional stars, contained in the Connaissance des Temps, but not in the other ephemerides, the reduction to mean place was computed by taking the difference between the tabular mean and apparent places, which in that catalogue are both given to the second decimal place only; in this case the correction Δ_1 is not applied. For all other stars the reduction to mean place (exclusive of proper motion) was computed to the nearest second decimal place for ten day intervals, all short-period terms being omitted, and interpolated for the dates required.

A thorough preliminary examination of the results was made for systematic effects depending on bisection error, on personal error of other kinds, and on the position of the instrument. For the effect of bisection error, means were taken separately of the n and r observations for each observer in each clamp, and the quantities $(r - n) \cos \delta$ tabulated, the sign being changed for stars observed north of the zenith at upper culmination. The resulting values of bisection error were .001 sec. for N and .003 sec. for S, the indicated error of setting being to the left in both cases. If we allow for the correction of .023 sec. applied to the observations of S in the computation, this result agrees with that deduced in Appendix A, as should be the case. As the results for separate stars showed considerable variation, it was not considered that these quantities were much, if any, in excess of their probable error: no correction was therefore applied to the right ascensions for this effect.

To investigate for other personal effects, means were taken separately for the observations of N and S in each clamp, and the results grouped in zones of declination 5° in width; the differences in the various zones, in the sense N − S, with their respective weights, are as follows:—

10°−15°	·008 sec	weight	107
15°−20°	·002 "	"	142
20°−25°	·015 "	"	87
25°−30°	·005 "	"	168
30°−35°	·001 "	"	161
35°−40°	·004 "	"	272
40°−45°	·002 "	"	239
45°−50°	·008 "	"	130
50°−55°	·006 "	"	71
55°−60°	·002 "	"	133
60°−65°	·080 "	"	2
65°−70°	·018 "	"	6
70°−75°	·004 "	"	170
75°−80°	·016 "	"	94
80°−	·157 "	"	6

These results were further weighted according to the cosine of the mean declination of each zone, and combined to deduce a formula for expressing the difference. Several simple formulae were tried; the one which appeared best to satisfy all the observations was $N-S = .0032 \sec \delta$; this was accordingly adopted. It is conceivable, however, that a constant correction for all declinations might better have been used; the value derived from the weighted mean of the south stars is .0044 sec.; that from the north stars .0066 sec.; from all stars .0048 sec. It is difficult to understand how any such difference could arise in the case of stars of the same declination as the clock-stars; as shown by the above table, however, it appears to be persistent for all declinations; a correction was therefore applied.

Means were next taken separately of the observations in Clamp West and Clamp East, and the results grouped as before for zones of declination 5° in width; the mean differences, in the sense W − E, are as follows:—

10°−15°	−·006 sec	weight	115
15°−20°	·000 "	"	135
20°−25°	−·008 "	"	91
25°−30°	·002 "	"	169
30°−35°	·003 "	"	171
35°−40°	·002 "	"	263
40°−45°	·007 "	"	231
45°−50°	·005 "	"	130
50°−55°	·019 "	"	68
55°−60°	·021 "	"	143
60°−65°	−·050 "	"	1
65°−70°	·023 "	"	4
70°−75°	·020 "	"	163
75°−80°	·045 "	"	93
80°−	·023 "	"	8

The formula adopted to represent these differences was $.0104 \tan \delta - .0048$, which gives a fairly satisfactory representation over the whole range of declination.

As the standard of reference for both the systematic corrections considered above, the mean of an equal number of observations by each observer in each position of the instrument was taken; the corrections to be applied to the right ascensions are therefore as follows:—

Clamp West,	$\Delta\alpha = -\ .0052 \tan \delta + .0024$
Clamp East,	$\Delta\alpha = \ \ .0052 \tan \delta - .0024$
Observations by N,	$\Delta\alpha = -\ .0016 \sec \delta$
Observations by S,	$\Delta\alpha = \ \ .0016 \sec \delta$

These are incorporated in the correction Δ_2 in the tables; it is always small, seldom amounting to more than a very few units in the third place of decimals; its only effect is to refer all observations, as nearly as may be, to the same standard.

Mean Right Ascensions.—In the tables headed "Mean Right Ascensions of Stars Observed in 1910" the final results are collected. The first three columns require no explanation; the fourth contains the approximate declination, merely for convenience of reference. In the fifth column is given the mean right ascension as taken from the ledgers; in the case of stars marked with an asterisk no proper motion was applied in the reduction to mean place for the beginning of the year; for those marked † the reduction to mean place was obtained from one or other of the ephemerides based on Newcomb's Fundamental Catalogue; the proper motions are therefore in this case Newcomb's; all other stars were reduced with the proper motions of Auwers. The sixth column gives the fraction of the year corresponding to the mean epoch of the observations, the seventh the number of observations.

In the next four columns are given, in the case of those stars on which at least ten observations were obtained, the differences between the observed right ascensions and those given in the Berlin Jahrbuch, Boss's "List of 1059 Standard Stars," the Greenwich Nine Year Catalogue for 1900, and Newcomb's Fundamental Catalogue, respectively; the differences are, however, not given for those stars to which no proper motion was applied in the reduction to mean place.

Systematic Corrections.—The differences mentioned above were grouped according to declination, the zones being 5° in width except in the case of 45° to 51½° and 51½° to 60°; as the latitude of Greenwich is approximately 51½°, this was chosen as one of the division points. There were no stars between 60° and 70° on which as many as ten observations were obtained. The means for the different zones are given below, followed in each case by the weight in brackets:—

Zone.	O.−B.J.	O.−B.	O.−G.	O.−N.
10°−15°	·003(11)	·003(11)	·013(6)	−·007(11)
15°−20°	·002(10)	·004(10)	·008(7)	·002(11)
20°−25°	−·001(7)	·003(8)	·001(7)	·004(8)
25°−30°	−·002(12)	·008(13)	−·007(10)	−·004(12)
30°−35°	−·015(10)	−·011(10)	−·011(8)	−·014(15)
35°−40°	−·010(16)	−·005(15)	·002(9)	−·023(18)
40°−45°	−·028(18)	−·013(17)	−·012(6)	−·051(18)
45°−51½°	−·027(12)	−·012(12)	−·020(4)	−·057(11)
51½°−60°	−·040(20)	−·032(19)	−·065(7)	−·065(14)
70°−75°	−·035(6)	−·046(6)	−·089(4)	−·005(5)
75°−80°	−·046(2)	−·096(3)	−·135(1)	−·141(3)

Grouping several of the zones together, we get the following more condensed arrangement, which does not appear to sacrifice accuracy:—

Zone	O.−B.J.	O.−B.	O.−G.	O.−N.
10°−30°	·000(40)	·005(42)	·002(30)	−·002(42)
30°−40°	−·012(26)	−·007(25)	−·004(17)	−·019(33)
40°−51½°	−·028(30)	−·013(29)	−·015(10)	−·053(29)
51½°−60°	−·040(20)	−·032(19)	−·065(7)	−·065(14)
70°−80°	−·038(8)	−·062(9)	−·098(5)	−·056(8)

The following points in this comparison are of special interest:—

(1) The large change in O.−G. at the zenith of Greenwich; this may undoubtedly be set down as a zenith error in the Greenwich observations, due probably to bisection error or some allied effect. The same change is shown in the other catalogues to a less extent; as the Greenwich observations entered largely into the material from which they were compiled, a part of the Greenwich error (assuming that it also existed in previous Greenwich catalogues) may have persisted in them.

(2) The marked change at 40° in O.−B.J. and O.−N., together with its comparative absence in O.−B. and O.−G. The evidence is here divided, but on account of the fairly close agreement of the Ottawa observations in Clamp West and Clamp East it might perhaps be a fair inference that the error is in B.J. and N.

(3) The almost complete absence of any change in the differences at 45°, the approximate latitude of Ottawa; this may be taken as evidence of a satisfactory absence of any appreciable zenith error in the Ottawa observations; it may be remarked that the omission of the correction for bisection error in the observations of S would have caused a change in the differences of over .01 sec. at 45°.

(4) From the evidence of all four catalogues, it appears that the Ottawa right ascensions for stars of over 30° declination are too small; the corrections applicable to reduce them to the Berlin Jahrbuch system may be taken as the following:

10° – 30°	.000 sec.
30° – 40°	.012 "
40° – $51\frac{1}{2}$°	.028 "
$51\frac{1}{2}$° – 80°	.039 "

A computation was also made, for stars below 40° declination, of differences of magnitude equation in the sense O.–B.J. and O.–B.; the above systematic corrections were first applied; the differences were not reduced to equatorial interval; the results were as follows:—

$$\text{O.} - \text{B.J.} = -.005\,(m-4)$$
$$\text{O.} - \text{B.} \;\; = \;\; .000\,(m-4)$$

As magnitude equation is supposed to have been eliminated from Boss, this may be taken as showing that the Ottawa observations are practically free from this effect. According to this, the magnitude equation of the Berlin Jahrbuch would be $-$ .005 $(m-4)$ sec. for stars near the equator.

Field Work

During the summer of 1910 the longitudes of Winnipeg, Windsor and Sault Ste. Marie were determined from Ottawa, the observer at the two former stations being Mr. McDiarmid, at the last Mr. Jaques. In addition, the longitudes of six stations in the west were determined from Winnipeg, Mr. Jaques occupying the base station and Mr. McDiarmid the outside stations. The latitudes of all the above stations were also determined.

Longitude of Winnipeg.—Especial care was used in the determination of this station, which will be largely used as a primary base station for western Canada. For the telegraphic exchanges one of the transcontinental copper wires of the Canadian Pacific Telegraph Co. was used; the low resistance and self-inductance of this wire made it possible to dispense completely with repeaters, there being a direct wire from the Observatory to the observing hut at Winnipeg. This materially increased the accuracy of the exchanges; the time of transmission of signals was only .06 sec., and was remarkably constant throughout the series of exchanges. A series of observations for personal equation was made before Mr. McDiarmid's departure for Winnipeg in May; after the longitude observations were concluded he returned to Ottawa, and a further determination of personal equation was made in June.

For the Ottawa observations the meridian circle was used, the two observers S and N participating in the work. The stars used for forming clock-corrections were those of the Berlin Jahrbuch between 30° and 60° of declination, an equal number being usually observed north and south of the zenith; the work was planned in this way in order to eliminate bisection error, as at that time the reversing prism eye-piece had not been received. The computation was the same as that described in the discussion of right ascension observations above, up to the point of formation of "adopted $\Delta T + m$". In the formation of this quantity all Berlin

Jahrbuch stars from 30° to 60° of declination were used; on this account it was possible to use two nights (April 26 and June 23) which were not included in the right ascension computation on account of lack of clock-stars. For south stars the same corrections were applied to "apparent $\Delta T + m$" as in the right ascension computation; for north stars the corrections adopted were −.04 sec. for S and −.02 sec. for N; these were obtained in the same way as the former ones, but the computation included only the period actually covered by the observations involved, Mar. 17 to June 29. As the same corrections were applied to both longitude and personal equation observations, any error in the actual corrections applied would be eliminated from the longitude results.

Personal Equation.—Observations for personal equation were made, as stated above, both before and after the determination of the longitude of Winnipeg. In these observations the two field observers, Mr. McDiarmid and Mr. Jaques (designated hereafter by M and J), as well as the two meridian circle observers N and S took part; in some instances all four observers worked simultaneously, while sometimes only two or three were engaged. Further observations were made in the autumn by M, N and S, J being incapacitated by illness.

The observations of M were made on the eastern transit pier, those of J on the western one, these being respectively .025 sec. and .014 sec. east of the meridian circle. All the observations for personal equation are collected in Table I, the above corrections for longitude, as well as corrections for clock rate between the epochs of observations on the same night, having been first applied to the observations of M and J.

Now take the mean of observations by each meridian circle observer in each clamp as standard, putting the personal difference of clock-correction in the sense S−N equal to 2X, and the instrumental difference in the sense W−E equal to 2C; also let M_1 and M_2 represent the personal equations of M in the spring and autumn respectively.

Then if a standard observation be denoted by A, those of the various observers will be

S, Cl. E.	$A - C + X$
S, Cl. W.	$A + C + X$
N, Cl. E.	$A - C - X$
N, Cl. W.	$A + C - X$
M, spring	$A - M_1$
M, autumn	$A - M_2$
J	$A - J$

Hence from the figures in Table I. we obtain the series of observation equations:

$$
\begin{aligned}
& && s \\
A_1 + C + X &= 4.847 \\
A_1 - M_1 &= 4.823 \\
A_2 + C - X &= 4.951 \\
A_2 - M_1 &= 4.934 \\
&\text{etc.}
\end{aligned}
$$

Combining the nights on which the same groups of observers were engaged, these observation equations become:

$$
\begin{aligned}
& && s \\
B_1 + C + X &= 3.991 \\
B_1 - M_1 &= 3.958
\end{aligned}
\Bigg\}\text{Weight 4}
$$

$$
\begin{aligned}
B_2 + C - X &= 2.303 \\
B_2 - M_1 &= 2.251 \\
&\text{etc.}
\end{aligned}
\Bigg\}\text{Weight 2}
$$

This combination evidently has no effect on the values deduced for C, X, M_1, M_2 and J (the values of A_1, A_2, etc., we are not particularly concerned with); it has the advantage of reducing the number of the normal equations, the reduction in this case being from 41 to 19.

Forming the normal equations, and solving for the quantities required, we obtain:

$$\begin{aligned} C &= .057 \text{ sec.} \\ X &= .006 \text{ "} \\ M_1 &= -.013 \text{ "} \\ M_2 &= -.062 \text{ "} \\ J &= .021 \text{ "} \end{aligned}$$

The corrections applicable to clock-corrections obtained by the various observers are therefore:

S, Cl. E.	.051 sec.
S, Cl. W.	− .063 "
N, Cl. E.	.063 "
N, Cl. W.	− .051 "
M, spring	− .013 "
M, autumn	− .062 "
J	.021 "

For the Winnipeg longitude the value M_1 was adopted as the personal equation of Mr. McDiarmid; for other stations it was computed from the formula $M_1 - .010$ (T − June 1), T being expressed in months.

The most striking point in the above result is the large difference of clock-correction (.114 sec.) obtained on reversal of the instrument. Since the right ascensions obtained Clamp East and Clamp West agree fairly closely, this difference must apparently be due to an error in the adopted level, which would affect clock-corrections but not right ascensions; it could not arise from pivot errors, since these are undoubtedly small.*

It is possible to compute what the observed error in clock-correction due to an error in adopted level should amount to, without knowing the error in level, by comparing the differences in observed azimuth on reversal of the instrument. These, as well as the observed differences of level, are tabulated below under the headings Δa and Δb respectively, the differences being taken in the sense Clamp E. − Clamp W. The intervals between the observations are given in each case; arbitrary weights depending on these intervals have been applied:

Date.	Δa	Δb	Interval.	Weight.
	sec.	sec.	days	
Apr. 2—3	·072	·174	1	1
" 21—22	·055	·148	1	1
May 15—16	·129	·118	1	1
" 21—26	·036	·130	5	¼
June 9—10	·113	·144	1	1
" 15—18	·050	·146	3	½
" 25—28	·038	·169	3	½
July 19—26	·109	·143	7	¼
Aug. 12—19	·074	·164	7	¼
Sep. 15—16	·106	·164	1	1
Oct. 11—12	·103	·199	1	1
Nov. 9—20	−·058	·101	11	¼
Weighted means	·083	·155		

* Report of Chief Astronomer, 1910, p. 407.

This establishes the fact that there is a systematic change in observed azimuth on reversal. Now assume a correction ∂b to the observed level error in Clamp East, and $-\partial b$ in Clamp West. Then since $a = b \tan \varphi - n \sec \varphi$, the letters employed having their usual significance, and since n is measured independently of the observed level, we have

$$\partial a_E = \partial b \tan \varphi$$
$$\partial a_W = -\partial b \tan \varphi$$

From these we obtain

$$\Delta a = \partial a_W - \partial a_E = -2\,\partial b \tan \varphi.$$

Hence, using the above observed mean value of Δa, we have

$$\partial b = -.041 \text{ sec.}$$

Similarly, from the formula $m = b \sec \varphi - n \tan \varphi$ we have for Clamp East

$$\partial m = \partial b \sec \varphi$$
or $$\partial(\Delta T) = -\partial b \sec \varphi = .058 \text{ sec.}$$

The close agreement of this result with that derived above (.057 sec) from the actual personal equation observations is remarkable; it is evident, therefore, that the observed difference in clock-correction might be fully accounted for by a systematic error in the adopted levels. If this is the case it must apparently be caused by some flexure effect which follows different laws when the telescope is pointed above and below the horizon.

Time Service.

The time service has been continued practically unchanged since my last report. Time signals are automatically sent out daily (Sundays excepted) to the Great North Western Telegraph Co., and the time ball on Parliament Hill is dropped daily by the signal clock. Mean and sidereal time are also given by telephone at any time to those requiring them; frequently the clockbeats are transmitted over the telephone line; the number of requests for time has become very large.

The usual amount of routine work has been done in connection with the maintenance of the time service and in testing of chronometers, watches, aneroid barometers, etc. The clock system in the Government Buildings has been in operation as usual; only two clocks have been added, a seconds dial and a minute dial in the residence of the Director. The total number of clocks in operation is now as follows:—

Minute Dials	283
Seconds Dials	6
Tower Clocks	2
Program Clock	1
Secondary Master-Clocks	8
Primary Clocks	4
Total	304

Time signals were exchanged with the Meteorological Observatory in Toronto on one occasion. The Toronto signals as received here were apparently about .1 sec. slow, and the Ottawa signals as received at Toronto were apparently about .2 sec. slow. Hence the Toronto clock was probably about .05 sec. faster than ours.

I have the honour to be, sir,

Your obedient servant,

R. M. STEWART.

APPENDIX A.

PERSONAL ERRORS OF BISECTION IN MERIDIAN CIRCLE WORK.

D. B. Nugent, M. A.

In determining the time of transit of a star over the same meridian, it has been found that the times obtained by two observers differ by a small but constant quantity. One observer, perhaps, acquires the habit of setting his wires always to the left of the star-image regardless of the direction of apparent motion of the star, while the other sets always to the right. In the former case the observer would observe the transits of stars north of the zenith at upper culmination too late and those south of the zenith too soon, and in the case of the latter it would be the reverse. This error of setting always to the left, or to the right, of the true setting is the personal error of bisection.

The object of this paper is to determine the magnitude of these errors in the case of the two observers—R. M. Stewart and D. B. Nugent—who are engaged in transit observations with the Meridian Circle at the Dominion Observatory. In order to do this, certain stars, varying from 10° to 80° in declination, were selected from our observing list and grouped in pairs according to their right ascension and their declination. In most cases the stars of a pair did not differ by more than 10^m in right ascension, and in no case did the difference exceed 30^m, while the difference in declination was always less than 5°. By using a reversing eye-piece, which consists of a glass prism mounted in front of an ordinary eye-piece, the position of the star-image can be turned through 180° by rotating the prism through 90°, and thus the apparent motion of a star across the field of the telescope reversed. If the star, the eye-piece being normal, crossed the meridian from west to east, then on turning the prism through 90° it would appear to cross from east to west. Each night the pairs were observed, one star was taken reversed, the same star being reversed on alternate nights. By comparing the observations on two successive nights the difference between a reversed and a normal observation was obtained.

The apparent right ascension of each star was determined for every night it was observed by using the following equation:

$$\alpha = \Delta T + T + c \sec \delta + m + n \tan \delta$$

where α = the apparent right ascension,

ΔT = the clock correction,

T = the clock time of transit of star;

$c \sec \delta$, m and $n \tan \delta$ are corrections depending on the collimation, level and azimuth of the instrument.

The clock correction ΔT used was that given by 3 or 4 stars whose declinations were not more than 10 degrees greater or less than the pairs to be compared and whose right ascensions were not greater nor less by more than an hour. The m and n were determined from all the stars observed on that night. The difference $\Delta\alpha$ between the value of α thus obtained and α_0, that given by the catalogues, is a measure of the error. The value of $\Delta\alpha$ was found for a reversed and a normal observation and the difference $(r-n)$ was twice the error of bisection. For the sake of comparison these values were all expressed in equatorial interval.

An example of the computation follows:—

Stars.	Date.	ΔT	ΔT	Obs.	T	a	a_0	Δa
		s	s		s	s	s	s
823	....	14·07	......	....	....	....	....	....
831	....	14·09	14·10	....	....	....	....	....
852	Sept. 28, 1910	14·13	......	....	....	....	....	....
833	....	......	......	r	2·52	16·49	16·54	—·05
835	....	......	......	n	47·61	61·58	61·58	·00
823	....	14·12	......	....	....	....	....	....
831	....	14·06	14·08	....	....	....	....	....
852	Sept. 30......	14·07	......	....	....	....	....	....
833	....	......	......	n	2·57	16·54	16·52	·02
835	....	......	......	r	47·62	61·59	61·55	·04
		r-n	cos δ		$(r$-$n)$ cos δ	$\frac{1}{2}(r-n)$ cos δ		
833	....	—·07	·841		—·059	—·029		
835	....	·04	·841		·034	·017		

The value of $(r-n)$ cos δ was found for each star, the sign being changed for stars north of the zenith, and was weighted according to the number of observations on each and the most probable value obtained from them.

My personal error obtained from 118 $(r-n)$ observations on 48 stars is .0013 sec., weight 118, and that of R. M. Stewart who had 138 $(r-n)$ observations on 70 stars is .0260 sec., weight 138. In my case the value is so small, and quite within the range of accidental errors, that my error of bisection may be taken as zero. In Mr. Stewart's case, however, we see that he has an error of bisection and that he sets his wires behind the star when the transit is north of the zenith and in advance of the star when the transit is to the south.

The results were examined to see if the error in any way depended on the declination of the star. To do this the stars were arranged in groups for every 5 degrees of declination and weighted according to the number of observations in each.

The following tables will show these values:

D. B. Nugent.			R. M. Stewart.		
Declination.	Error.	Weight.	Declination.	Error.	Weight.
10° to 15°.............	·006	12	10° to 15°..........	·016	8
15 " 20..............	—·008	7	15 " 20	·027	5
20 " 25	·003	13	20 " 25	·035	9
25 " 30	·002	4	25 " 30	·021	6
30 " 35	—·008	20	30 " 35	·043	10
35 " 40	·010	21	35 " 40	·022	30
40 " 45	·011	12	40 " 45	·025	14
50 " 55	—·003	6	45 " 50...........	·031	11
55 " 60	·002	9	50 " 55	·030	5
70 " 75	·001	14	55 " 60	·010	8
			70 " 75	·028	24
			75 " 80	·027	8
	·0016	118		·0262	138

In neither case do we see any systematic change depending on the difference in declination. The difference between the error of any group and the mean error is so small that I think we may take it to be within the limits of accidental errors.

The stars were next grouped according to their magnitudes, the difference between the smallest and the greatest of any group being 0.5 of a magnitude. No relation between the error and the magnitude of the star was established.

D. B. Nugent.			R. M. Stewart.		
Magnitude.	Error.	Weight.	Magnitude.	Error.	Weight.
	s.			s.	
2 to 2·5	—·005	9	1	·019	1
3 " 3·5	—·016	5	2 to 2·5	·021	11
3·5 " 4	·006	18	3 " 3·5	·015	8
4 " 4·5	·011	15	3·5 4	·028	13
4·5 " 5	·014	20	4 " 4·5	·030	17
5 " 5·5	—·005	16	4·5 " 5	·023	20
5·5 " 6	—·014	16	5 " 5·5	·026	27
6 " 6·5	·004	14	5·5 " 6	·029	23
6·5 " 7	·012	1	6 " 6·5	·028	17
7·2	—·014	4	7·2	·009	1
	—·0007	118		·0227	138

For stars over 80° declination, whose motion is slow compared with one at the equator, the method of observation was changed, a reversed and a normal observation being obtained of the same transit instead of taking the whole transit normally one night and reversed the next as was the case with those we have considered.

In following the star across the field of the instrument twenty settings are recorded, which are arranged in four groups of five settings, two groups being placed symmetrically on each side of the line of collimation. With this arrangement the first and the last group may be observed with the eye-piece normal and the second and the third with it reversed, or vice-versa, thus giving the time of transit obtained with the star moving in opposite directions. The difference between a normal and a reversed observation, changing the sign for stars at lower culmination, was taken as twice the error of bisection and for comparison these were reduced to the equatorial interval.

My error, determined from 100 observations on 16 stars, is .0025 sec., which may be considered as zero; and that of Mr. Stewart, determined from 146 observations on 19 stars, .0162 sec., a value slightly smaller than in the case of stars from 10° to 80° declination.

As in the former case the results were examined to see if there were any changes depending on the declination or the magnitude. The error was also determined separately for the stars observed at upper culmination and for those observed at lower. The changes were so small in all four cases for both observers that they were probably due to accidental errors. The following table will show these values for the two observers:—

D. B. Nugent.			R. M. Stewart.		
Declination.	Error.	Weight.	Declination.	Error.	Weight.
	s.			s.	
80° to 85°............	·0013	59	80° to 85°..........	·0178	71
85 " 90.............	·0041	41	85 " 90...........	·0146	75
Magnitudes.			Magnitudes.		
4 to 4·5............	·0018	24	2 to 2·5..........	·0074	8
5 " 5·5............	·0007	38	4 " 4·5..........	·0163	16
5·5 " 6..............	·0034	13	4·5 " 5............	·0154	20
6 " 6·5............	·0042	13	5 " 5·5..........	·0211	40
7 " 7·5............	·0062	12	5·5 " 6............	·0153	29
			6 " 6·5..........	·0110	11
			6·5 " 7............	·0143	9
			7 " 7·5..........	·0147	13
Stars at Upper Culmination.........	·0020	62	Stars at Upper Culmination......	·0177	67
Stars at Lower Culmination.........	·0032	38	Stars at Lower Culmination......	·0148	79

The results obtained from the whole investigation may be summarized as follows:—

(*a*) That D. B. Nugent has no personal error of bisection.

(*b*) That R. M. Stewart has an error, always setting the wires to the left of the star image.

(*c*) That in neither case does the error depend upon the magnitude of the star observed or whether it is observed at upper or at lower culmination.

(*d*) That for R. M. Stewart there is a small difference between the value obtained from stars under 80° and that from stars over 80° in declination, but there does not appear to have been any systematic change in either group depending on the declination.

TABLE I.

OBSERVATIONS FOR PERSONAL EQUATION.

(Corrected for clock-rate and difference of longitude).

Date.	Sidereal Time.	Clamp (Mer.Circle)	Clock-correction.			
			S	N	M	J
1910	h. m.		s.	s.	s.	s.
Mar. 17......	9 20	W	4·847	....	4·823	....
" 18......	9 00	W	....	4·951	4·934	....
" 26......	11 20	W	4·474	....	4·439	....
Apr. 2......	11 00	W	3·882	....	3·820	3·778
" 3......	10 40	E	3·797	....	3·904	....
" 8......	12 50	E	....	−14·803	−14·697	−14·732
" 10......	10 15	E	−14·823	....	−14·712	....
" 11......	10 20	E	....	−16·705	−16·719	−16·706
" 12......	12 50	E	....	−16·571	....	−16·606
" 13......	10 40	E	− 4·649	....	− 4·592	− 4·673
" 14......	10 20	E	−20·905	....	−20·884	−20·932
" 21......	10 20	E	....	− 1·613	− 1·576	− 1·618
" 22......	10 20	W	....	− 1·511	− 1·495	− 1·534
" 25......	11 15	W	− 1·217	....	....	− 1·298
" 26......	9 45	W	....	− 1·085	....	− 1·160
" 27......	12 45	W	− 1·029	....	− 1·056	− 1·074
" 28......	10 15	W	....	− ·898	− ·941	− ·979
" 30......	11 50	W	− ·834	....	− ·900	− ·952
May 3......	11 45	W	....	− ·664	....	− ·677
" 5......	13 05	W	− ·320	....	− ·488	− ·424
" 6......	13 45	W	....	− ·345	− ·433	....
" 7......	12 50	W	− ·286	....	− ·436	− ·442
June 13......	15 10	E	2·497	2·487	2·539	2·545
" 15......	15 10	E	2·679	2·687	2·791	2·785
" 18......	15 10	W	3·078	3·057	3·051	....
" 19......	15 10	W	3·170	3·110	3·107	....
" 23......	16 10	W	3·269	....	3·232	....
" 25......	16 10	W	3·374	....	3·337	....
" 28......	16 05	E	3·528	....	3·660	....
" 29......	16 05	E	3·673	....	3·785	....
Oct. 19......	21 45	E	....	18·965	19·132	....
" 20......	23 10	E	19·404	....	19·524	....
" 21......	23 25	E	19·754	....	19·859	....
" 26......	21 35	E	....	21·880	21·968	....
Nov. 2......	23 50	E	....	24·790	24·872	....
" 9......	23 20	E	....	27·605	27·752	....

TABLE II.

OBSERVED VALUES OF COLLIMATION AND LEVEL.

Date.	Clamp.	Observer.	Time.	Collimation Line.	Time.	Vertical Line.	Temp. (Cent.)	Adopted Coll.	Adopted Level.
1910			h. m.	r	h. m.	r	°	s.	s.
Mar. 11.....	W	S	9 25	9·5932	11 05	9·6106	....	....	....
" 16.....	E	S	....	9·6080	....	9·5426	....	....	....
" 17.....	W	S	8 30	9·6043	8 00	9·6438	....	−·054	·109
	W	S	10 25	9·6055	11 05	9·6336	....	....	....
" 18.....	W	N	6 55	9·5944	7 20	9·6255	....	−·018	·103
	W	N	11 05	9·5926	11 25	9·6256	....	....	....
	W	N	23 15	9·5950	22 45	9·6304	....	....	....
" 19.....	W	S	9 40	9·5900	9 55	9·6276	−0·2	....	....
" 20.....	W	S	2 20	9·5954	1 50	9·6273	2·8	....	....
	W	S	8 00	9·5930	8 20	9·6242	2·8	....	....
" 22.....	W	N	4 00	9·5950	4 20	9·6267	....	....	....
	W	CS	23 30	9·6003	....	9·6304	....	....	....
" 23.....	W	CS	23 30	9·6069	23 40	9·6356	4·7	....	....
" 24.....	W	CS	23 20	9·6094	....	9·6310	9·5	....	....
" 25.....	W	S	4 15	9·6087	4 30	9·6279	9·2	....	....
	W	CS	23 30	9·6026	....	9·6314	6·8	....	....
" 26.....	W	S	9 20	9·6095	9 35	9·6303	6·8	−·081	·069
	W	S	11 50	9·6167	12 25	9·6388	3·8	....	....
" 27.....	W	S	1 45	9·6080	2 00	9·6358	6·9	....	....
" 28.....	W	S	2 20	9·6004	2 55	9·6482	13·0	....	....
	W	CS	7 25	9·6107	7 15	9·6359	13·2	....	....
	W	CS	13 30	9·6166	13 45	9·6386	8·1	....	....
	W	N	23 15	9·6118	23 30	9·6389	10·8	....	....
" 29.....	W	CS	23 05	9·6174	23 30	9·6382	10·5	....	....
Apr. 1.....	W	N	6 35	9·6204	6 50	9·6332	10·2	....	....
" 2.....	W	S	8 05	9·6267	8 20	9·6410	10·0	−·091	·038
	W	S	12 30	9·6313	12 00	9·6406	5·8	....	....
" 3.....	W	S	6 20	9·6222	6 55	9·6501	10·2	....	....
	E	S	8 35	9·6212	8 15	9·5565	9·6	·075	·212
	E	S	11 25	9·6264	11 10	9·5593	6·0	....	....
" 4.....	E	N	2 25	9·6247	2 45	9·5556	9·8	....	....
" 5.....	E	N	3 05	9·6185	3 20	9·5479	15·4	....	....
	E	CS	9 00	9·6209	....	9·5481	15·3	....	....
	E	CS	11 30	9·6248	11 45	9·5568	14·7	....	....
" 6.....	E	N	2 50	9·6204	3 20	9·5604	14·4	....	....
	E	S	10 20	9·6297	11 40	9·5615	11·0	....	....
" 8.....	E	N	2 45	9·6340	3 00	9·5372	6·0	....	....
	E	N	10 10	9·6394	10 20	9·5380	5·8	·108	·306
	E	N	13 25	9·6289	13 35	9·5403	....	....	....
	E	CS	23 45	9·6274	24 00	9·5407	5·6	....	....
" 10.....	E	S	7 05	9·6310	7 25	9·5400	6·7	·098	·286
	E	S	10 35	9·6312	10 50	9·5443	4·0	....	....
" 11.....	E	N	3 50	9·6316	4 05	9·5355	7·7	....	....
	E	N	7 00	9·6276	7 10	9·5391	5·9	·092	·280
	E	N	10 30	9·6308	10 45	9·5452	2·8	....	....
" 12.....	E	N	10 05	9·6355	10 15	9·5430	2·2	·113	·306
	E	N	12 30	9·6362	12 40	9·5385	2·5	....	....
13.....	E	S	7 55	9·6311	8 15	9·5362	6·7	·089	·290
	E	S	10 15	9·6257	10 30	9·5402	6·0	....	....
" 14.....	E	S	7 15	9·6250	7 30	9·5459	9·3	·082	·253
	E	S	10 15	9·6275	10 30	9·5493	8·5	....	....
" 19.....	E	N	2 45	9·6233	3 00	9·5442	13·2	....	....
" 20.....	E	N	3 40	9·6308	4 00	9·5467	12·6	....	....

TABLE II.

OBSERVED VALUES OF COLLIMATION AND LEVEL—(Continued).

Date.	Clamp.	Observer.	Time.	Collimation Line.	Time.	Vertical Line.	Temp. (Cent.)	Adopted Coll.	Adopted Level.
1910			h. m.	r	h. m.	r	°	s.	s.
Apr. 21.....	E	N	6 45	9·6292	7 00	9·5481	12·5	·097	·257
	E	N	9 45	9·6322	10 00	9·5534	11·3	....	....
	E	N	23 15	9·6300	23 40	9·5562	12·8	....	....
" 22.....	W	N	1 10	9·6447	1 30	9·6779	14·0	....	....
	W	N	6 35	9·6385	6 50	9·6781	15·4	—·129	·109
	W	N	9 45	9·6426	10 00	9·6709	12·6	....	....
" 25.....	W	S	7 35	9·6409	7 55	9·6688	15·1	—·141	·077
	W	S	9 50	9·6477	10 15	9·6677	13·9	....	....
" 26.....	W	N	6 35	9·6486	6 50	9·6623	15·8	....	....
27.....	W	S	8 30	9·6482	8 50	9·6813	10·8	—·162	·102
	W	S	12 00	9·6536	12 25	9·6839	3·3	....	....
" 28.....	W	N	6 35	9·6427	6 50	9·6834	8·3	—·141	·134
	W	N	9 30	9·6462	9 45	9·6885	6·3	....	....
" 30.....	W	S	7 00	9·6496	7 15	9·6832	10·5	—·162	·105
	W	S	9 55	9·6521	10 10	9·6841	9·4	....	....
May 3.....	W	N	6 45	9·6402	7 20	9·6813	9·0	—·139	·123
	W	N	10 15	9·6472	10 30	9·6828	7·6	....	....
" 5.....	W	S	8 10	9·6486	8 25	9·6810	11·3	—·167	·105
	W	S	11 50	9·6562	12 05	9·6893	7·9	....	....
" 6.....	W	N	9 20	9·6465	9 35	9·6779	12·4	—·160	·095
	W	N	12 00	9·6544	12 15	9·6821	....	....	....
" 7.....	W	S	7 40	9·6486	7 55	9·6722	16·4	—·174	·063
	W	S	12 25	9·6597	12 40	9·6763	11·8	....	....
" 10.....	W	N	6 45	9·6480	7 00	9·6776	14·0	—·162	·089
	W	N	10 45	9·6540	11 00	9·6800	11·2	....	....
" 11.....	W	S	7 10	9·6582	6 55	9·6851	12·1	—·196	·082
	W	S	12 30	9·6647	12 45	9·6890	8·4	....	....
" 12.....	W	N	7 10	9·6551	7 25	9·6811	11·2	—·176	·085
	W	N	11 00	9·6556	11 15	9·6825	5·2	....	....
" 14.....	W	N	9 40	9·6708	9 55	9·6824	9·3	....	....
" 15.....	W	S	7 10	9·6583	7 30	9·6806	13·4	·000	·065
	W	S	12 30	9·6620	12 45	9·6799	8·7	....	....
" 16.....	E	N	7 15	9·6514	7 30	9·5961	15·6	·016	·183
	E	N	11 30	9·6584	11 45	9·6000	11·8	....	....
" 17.....	E	S	7 55	9·6600	8 15	9·6019	17·8	—·003	·178
	E	S	10 20	9·6582	11 10	9·6054	16·0	....	....
" 18.....	E	N	6 45	9·6568	7 00	9·5998	11·7	....	....
" 19.....	E	S	8 25	9·6588	8 40	9·5987	13·3	·004	·199
	E	S	13 10	9·6634	13 30	9·5995	8·8	....	....
" 21.....	E	N	7 45	9·6512	8 00	9·5909	15·3	·015	·193
	E	N	11 15	9·6593	11 30	9·5997	13·4	....	....
" 22.....	E	S	9 20	9·6594	9 30	9·5976	16·7	....	....
" 26.....	W	N	7 45	9·6625	8 00	9·6805	15·7	—·014	·063
	W	N	12 45	9·6662	13 15	9·6872	10·5	....	....
" 27.....	W	S	8 35	9·6608	8 55	9·6807	15·0	—·011	·065
	W	S	13 35	9·6658	13 50	9·6862	11·4	....	....
" 28.....	W	N	7 45	9·6599	8 00	9·6797	19·4	—·002	·060
	W	N	11 50	9·6616	12 05	9·6792	15·6	....	....
" 30.....	W	N	7 15	9·6574	7 30	9·6796	15·4	....	....
June 2.....	W	S	8 30	9·6632	8 45	9·6816	15·2	....	....
" 3.....	W	S	7 20	9·6644	7 30	9·6888	13·4	—·025	·084
	W	S	11 50	9·6712	12 05	9·6989	7·8	....	....
" 4.....	W	S	7 50	9·6633	8 10	9·6851	13·5	—·017	·067
	W	S	12 50	9·6670	13 10	9·6869	9·1	....	....
" 7.....	W	S	11 40	9·6647	11 50	9·6800	12·5	—·021	·048
	W	S	15 15	9·6685	15 30	9·6832	9·5	....	....

TABLE II.

OBSERVED VALUES OF COLLIMATION AND LEVEL—(Continued).

Date.	Clamp.	Observer.	Time.	Collimation Line.	Time.	Vertical Line.	Temp. (Cent.)	Adopted Coll.	Adopted Level.
1910			h. m.	r	h. m.	r	°	s.	s.
June 8.....	W	N	7 00	9·6612	7 15	9·6805	16·2	−·012	·054
	W	N	11 15	9·6664	11 30	9·6808	12·5		
" 9.....	W	S	7 40	9·6647	7 50	9·6727	17·6	−·021	·027
	W	S	12 00	9·6683	12 15	9·6772	13·2		
	W	S	22 35	9·6604					
	E	S	23 50	9·6637					
" 10.....	E	N	8 30	9·6626	8 45	9·6077	18·4	·003	·171
	E	N	11 10	9·6594	11 20	9·6077	15·6		
" 13.....	E	N	7 00	9·6588	7 20	9·6061	22·2	·002	·172
	E	N	12 10	9·6625	12 25	9·6082	18·5		
" 14.....	E	S	7 25	9·6669	7 45	9·6156	24·2		
" 15.....	E	S	7 15	9·6657	7 35	9·6146	23·9	·028	·168
	E	S	12 05	9·6715	12 15	9·6179	19·0		
" 17.....	E	N	3 00	9·6662	3 15	9·6125			
	W	N	3 50	9·6673	4 05	9·6715			
" 18.....	W	N	7 15	9·6638	7 30	9·6699	23·8	−·020	·022
	W	N	11 15	9·6688	11 30	9·6765	20·4		
" 19.....	W	S	7 10	9·6659	7 25	9·6738	24·9	−·023	·022
	W	S	11 25	9·6687	11 40	9·6747	21·3		
" 23.....	W	S	6 55	9·6667	7 15	9·6698	23·9		
	W	S	12 25	9·6691	12 40	9·6744	17·8		
" 24.....	W	S	8 00	9·6666	8 20	9·6719	23·3		
" 25.....	W	S	7 40	9·6638	7 55	9·6644	25·3	−·020	·004
	W	S	12 15	9·6687	12 35	9·6704	19·9		
" 28.....	E	S	7 25	9·6702	7 40	9·6185	23·8	·038	·173
	E	S	11 55	9·6734	12 15	9·6177	17·6		
" 29.....	E	S	7 45	9·6707	7 55	9·6191	24·2	·035	·166
	E	S	11 55	9·6713	12 10	9·6199	20·6		
July 4.....	E	S	8 30	9·6721	8 45	9·6193	22·8	·042	·180
	E	S	12 05	9·6743	12 25	9·6153	19·0		
" 5.....	E	S	7 20	9·6707	7 35	9·6255	25·2	·032	·153
	E	S	11 50	9·6694	12 05	9·6193	19·1		
" 6.....	E	N	7 30	9·6731	7 45	9·6327	26·0	·038	·126
	E	N	10 30	9·6708	10 45	9·6329	23·0		
" 11.....	E	N	7 15	9·6709	7 45	9·6170	25·4	·037	·174
	E	N	10 35	9·6721	10 50	9·6178	22·2		
" 13.....	E	N	7 00	9·6703	7 15	9·6142	25·2	·034	·173
	E	N	10 50	9·6707	11 05	9·6194	21·2		
" 16.....	E	S	8 30	9·6739	8 50	9·6247	23·3	·047	·170
	E	S	13 05	9·6753	13 25	9·6188	16·4		
" 19.....	E	S	7 55	9·6721	8 10	9·6244	23·2	·040	·158
	E	S	12 30	9·6725	12 50	9·6220	17·8		
" 20.....	E	N	2 10	9·6730	2 25	9·6193	23·4		
	W	N	3 40	9·6715	4 00	9·6752			
" 25.....	W	N	8 40	9·6726	8 55	9·6765	23·2		
" 26.....	W	S	7 55	9·6719	8 10	9·6790	23·9	−·046	·015
	W	S	12 25	9·6769	12 45	9·6792	19·6		
" 28.....	W	N	9 30	9·6754	9 45	9·6788	23·0	−·060	·002
	W	N	12 30	9·6820	12 45	9·6800	15·0		
" 30.....	W	N	9 45	9·6747	10 00	9·6775	21·2	−·034	·024
	W	N	12 45	9·6662	13 00	9·6786	15·4		
Aug. 2.....	W	S	9 00	9·6723	9 15	9·6720	22·2	−·040	−·001
" 4.....	W	S	7 40	9·6734	7 55	9·6665	22·4		
" 7.....	W	S	7 50	9·6724	8 05	9·6705	21·5	−·040	−·001
	W	S	11 45	9·6726	12 00	9·6741	18·3		
" 8.....	W	N	8 15	9·6718	8 30	9·6709	21·5	−·043	−·005
	W	N	11 40	9·6748	11 55	9·6726	18·6		

TABLE 11.

OBSERVED VALUES OF COLLIMATION AND LEVEL (Continued).

Date.	Clamp.	Observer.	Time.	Collimation Line.	Time.	Vertical Line.	Temp. (Cent.)	Adopted Coll.	Adopted Level.
1910			h. m.	r	h. m.	r	°	s.	s.
Aug. 9	W	S	7 45	9·6714	7 55	9·6674	23·4	......	......
" 11	W	S	7 25	9·6704	7 10	9·6808	22·7	−·041	·032
	W	S	12 20	9·6750	12 35	9·6848	18·2	......	......
" 12	W	N	7 05	9·6705	7 20	9·6804	24·3	−·042	·031
	W	N	11 15	9·6756	11 30	9·6852	19·0	......	......
" 18	E	S	11 35	9·6744	11 50	9·6180	18·6	......	......
	E	S	14 20	9·6731	14 40	9·6162	15·0	......	......
" 19	E	N	7 00	9·6703	7 15	9·6097	20·3	·035	·195
	E	N	9 50	9·6713	10 05	9·6105	16·1	......	......
" 20	E	S	8 00	9·6733	7 45	9·6103	20·9	·046	·210
	E	S	12 00	9·6754	12 20	9·6080	16·2	......	......
" 26	E	N	7 15	9·6771	7 30	9·5982	19·2	·047	·244
	E	N	10 15	9·6723	10 30	9·5994	14·0	......	......
" 29	E	N	7 00	9·6753	7 25	9·6019	20·0	·044	·227
	E	N	10 45	9·6718	11 00	9·6038	15·3	......	......
" 31	E	N	9 15	9·6723	9 30	9·6106	20·3	·043	·203
	E	N	12 05	9·6744	12 20	9·6097	15·8	......	......
Sept. 1	E	S	7 05	9·6775	7 15	9·6072	18·8	·056	·226
	E	S	12 25	9·6776	12 10	9·6071	14·6	......	......
" 2	E	N	7 30	9·6731	7 45	9·6045	18·4	·041	·219
	E	N	11 30	9·6726	11 45	9·6047	13·2	......	......
" 7	E	S	11 45	9·6751	11 30	9·6075	16·9	·053	·226
	E	S	16 55	9·6782	16 35	9·6049	12·0	......	......
" 8	E	CS	7 00	9·6779	....	9·6060	19·0	·055	·236
	E	S	12 10	9·6761	12 25	9·6014	17·8	......	......
" 9	E	N	7 30	9·6764	7 15	9·5988	16·5	·051	·250
	E	N	11 00	9·6753	11 15	9·5974	11·4	......	......
" 10	E	S	8 10	9·6750	8 00	9·5976	16·0	·056	·269
	E	S	12 50	9·6797	13 10	9·5901	12·1	......	......
" 13	E	S	7 05	9·6776	6 50	9·5968	15·0	·059	·265
	E	S	11 50	9·6792	12 10	9·5949	9·0	......	......
" 14	E	N	7 40	9·6710	7 20	9·5922	15·4	·035	·256
	E	N	11 15	9·6706	11 30	9·5900	11·3	......	......
" 15	E	S	7 35	9·6738	7 25	9·5918	16·2	·048	·269
	E	S	12 15	9·6761	12 30	9·5909	11·4	......	......
" 16	W	N	7 30	9·6721	7 15	9·7030	18·0	−·038	·105
	W	N	11 15	9·6717	11 30	9·7059	14·2	......	......
" 17	W	S	7 20	9·6739	7 10	9·7004	18·6	−·048	·088
	W	S	10 40	9·6757	10 55	9·7039	15·6	......	......
" 19	W	N	7 30	9·6707	7 15	9·7101	13·4	−·040	·124
	W	N	10 45	9·6739	11 00	9·7116	10·8	......	......
" 21	W	N	7 00	9·6699	....	9·7059	14·0	−·048	·102
	W	N	12 25	9·6802	12 45	9·7077	8·0	......	......
" 22	W	S	7 10	9·6745	7 00	9·7087	13·0	−·053	·119
	W	S	10 40	9·6782	11 10	9·7183	9·2	......	......
" 26	W	N	6 45	9·6708	7 00	9·7030	14·8	−·043	·097
	W	N	10 15	9·6762	10 30	9·7042	11·8	......	......
" 27	W	S	8 35	9·6705	8 20	9·6997	14·4	−·043	·105
	W	S	13 45	9·6764	14 05	9·7125	10·4	......	......
" 28	W	N	7 30	9·6698	7 00	9·7050	13·5	−·042	·111
	W	N	10 45	9·6761	11 00	9·7097	11·4	......	......
" 29	W	S	6·45	9·6722	6 35	9·7028	15·3	−·044	·114
	W	S	11 50	9·6752	12 05	9·7153	10·7	......	......
" 30	W	N	6 40	9·6720	6 20	9·7056	16·8	−·034	·118
	W	N	10 30	9·6691	10 45	9·7092	14·3	......	......

TABLE II.

OBSERVED VALUES OF COLLIMATION AND LEVEL (Concluded).

Date.	Clamp.	Observer.	Time.	Collimation Line.	Time.	Vertical Line.	Temp. (Cent.)	Adopted Coll.	Adopted Level.
1910			h. m.	r	h. m.	r	°	s.	s.
Oct. 2.....	W	S	8 25	9·6738	8 10	9·7204	11·4	....	....
" 3.....	W	N	7 30	9·6736	....	9·7115	13·2	−·045	·126
	W	N	10 50	9·6742	11 00	9·7147	11·4	....	....
" 7.....	W	N	6 40	9·6715	6 55	9·7381	13·3	−·046	·215
	W	N	10 45	9·6768	11 00	9·7439	9·4	....	....
" 10.....	W	N	6 30	9·6718	6 45	9·7291	11·9	−·048	·180
	W	N	10 40	9·6783	10 55	9·7330	9·7	....	....
" 11.....	W	S	6 25	9·6729	6 10	9·7200	14·6	−·049	·155
	W	S	10 30	9·6776	10 50	9·7270	11·2	....	....
" 12.....	E	N	6 45	9·6807	7 00	9·5721	8·8	·068	·354
	E	N	9 45	9·6817	10 05	9·5700	3·0	....	....
" 17.....	E	N	6 35	9·6731	6 50	9·5815	13·7	·041	·296
	E	N	10 30	9·6723	10 45	9·5799	11·2	....	....
" 18.....	E	S	6 35	9·6747	6 55	9·5862	13·0	·048	·297
	E	S	11 55	9·6752	12 10	9·5789	9·6	....	....
" 19.....	E	N	6 30	9·6729	6 15	9·5805	15·6	·036	·292
	E	N	9 30	9·6695	9 45	9·5800	14·5	....	....
" 20.....	E	S	7 00	9·6784	6 45	9·5818	10·3	·055	·305
	E	S	11 50	9·6761	12 15	9·5833	6·0	....	....
" 21.....	E	S	7 30	9·6799	7 15	9·5758	8·2	·062	·334
	E	S	11 55	9·6785	12 15	9·5747	4·7	....	....
" 26.....	E	N	7 00	9·6747	7 30	9·5742	6·0	·022	·308
	E	N	9 30	9·6592	9 50	9·5683	3·2	....	....
Nov. 2.....	E	N	7 00	9·6556	7 20	9·5661	6·6	·018	·279
	E	N	10 40	9·6756	10 55	9·5913	2·3	....	....
" 3.....	E	S	8 55	9·6781	8 35	9·5844	3·2	....	....
" 4.....	E	N	7 50	9·6742	7 30	9·5838	5·2	·049	·292
	E	N	9 55	9·6762	10 15	9·5849	3·8	....	....
" 8.....	E	S	7 00	9·6753	6 30	9·5846	1·2	·055	·294
	E	S	12 00	9·6792	12 25	9·5869	− 2·7	....	....
" 9.....	E	N	6 30	9·6719	6 05	9·5843	1·8	·041	·285
	E	N	10 05	9·6734	10 20	9·5839	− 1·0	....	....
" 17.....	E	N	7 00	9·6724	7 30	9·5793	− 1·3	....	....
20.....	W	S	5 40	9·6717	5 25	9·7288	− 1·0	−·038	·184
" 27.....	W	S	6 15	9·6707	6 35	9·7183	0·2	−·041	·149
	W	S	9 50	9·6745	10 10	9·7196	− 1·4	....	....
Dec. 3.....	W	S	4 35	9·6776	....	....	− 3·8	....	....
" 5.....	W	N	6 10	9·6829	6 30	9·7524	− 6·2	−·073	·222
	W	N	10 20	9·6828	10 40	9·7516	−10·0	....	....
" 6.....	W	S	4 35	9·6776	9 50	9·7032	− 7·5	....	....
" 8.....	W	S	5 00	9·6299	4 30	9·6837	− 6·0	·074	·184
	W	S	10 20	9·6443	10 45	9·7050	−10·3	....	....
" 9.....	W	N	6 55	9·6476	6 40	9·7093	−11·0	·022	·198
	W	N	10 05	9·6588	10 35	9·7205	−15·2	....	....
" 10.....	W	S	5 05	9·6467	4 30	9·7278	−11·8	·043	·249
	W	S	11 05	9·6748	11 20	9·7487	−14·2	−·048	....
" 12.....	W	N	7 00	9·6644	6 45	9·7632	−10·6	−·020	·319
	W	N	10 15	9·6682	10 30	9·7681	−11·0	....	....
" 16.....	W	N	6 45	9·6698	7 00	9·7686	−11·6	....	....
" 21.....	W	N	7 15	9·6617	7 00	9·7812	− 9·0	−·022	·378
	W	N	10 30	9·6721	10 50	9·7874	−13·0	....	....
" 25.....	W	S	4 20	9·6665	3 40	9·7799	− 8·8	....	....
	W	S	8 50	9·6735	....	....	−12·2	....	....
" 30.....	W	S	5 10	9·6646	7 45	9·7678	−10·0	....	....

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent ΔT + m	Adopted ΔT + m	App. R.A. from Observation
1910					h. m. s.	s.	s	s.	s.	s.	h. m. s.
Mar. 17	1	B.J. 320.......		S	8 27 00·12	−·054	00·44	05·02	4·58	4·54	8 27 04·98
	2	B.J. 323.......		"	32 34·10	(·456)	34·58	39·14	......		32 39·12
	3	76 Draconis...	L.C.	"	48 59·99		56·96	01·73	4·77		....
	4	B.J. 335.......		"	52 59·36		59·76	04·35	......		53 04·30
	5	B.J. 339.......		"	54 44·33		44·70	49·25	4·55		54 49·24
	6	B.J. 341.......		"	57 25·52		25·90	30·47	......		57 30·44
	7	B.A.C. 3097...		"	9 00 44·72		45·04	......	......		9 00 49·58
	8	B.J. 346.......		"	07 51·59		51·98	56·57	4·59		07 56·52
	9	B.J. 349.......		"	13 11·13		11·44	15·99	4·55		13 15·98
	10	B.A.C. 7504...	L.C.	"	17 19·49		12·39	17·98	5·59		....
	11	1 H. Draconis		"	24 20·51		23·19	28·10	4·91		....
	12	B.J. 358.......		"	26 47·28		47·73	52·32	......		26 52·27
	13	B.J. 360.......		"	28 39·21		39·51	44·02	4·51		28 44·05
	14	B.J. 368.......		"	44 32·97		33·60	38·18	......		44 38·14
	15	B.J. 374.......		"	52 07·07		07·43	12·02	4·59		52 11·97
	16	B.J. 383.......		"	10 11 37·05		37·44	41·98	4·54		10 11 41·98
	17	30 H. Camel..		"	20 14·97		18·16	22·87	4·71		....
	18	B.J. 394.......		"	24 49·67		50·22	54·74	......		24 54·76
	19	B.J. 398.......		"	29 19·54		20·11	24·71	......		29 24·65
	20	B.J. 416.......		"	56 22·29		22·85	27·48	......		56 27·39
Mar. 18	21	B.J. 296.......		N	7 41 37·94	−·018	38·24	42·86	4·62	4·61	7 41 42·85
	22	Groom. 1119..		"	8 08 49·86	(·477)	14·79	22·61	7·82		....
	23	B.J. 314.......		"	16 36·49		36·91	41·57	4·66		8 16 41·52
	24	B.J. 320.......		"	27 00·02		00·38	05·00	4·62		27 04·99
	25	B.J. 323.......		"	32 33·98		34·58	39·12	......		32 39·19
	26	76 Draconis...	L.C.	"	49 00·32		57·05	01·83	4·78		....
	27	220 H¹. Drac..	L.C.	"	51 33·56		30·95	35·75	4·80		....
	28	B.J. 339.......		"	54 44·09		44·50	49·24	4·74		54 49·11
	29	B.J. 341.......		"	57 25·31		25·80	30·46	......		57 30·41
	30	B.A.C. 3097...		"	9 00 44·61		44·97	......	......		9 00 49·58
	31	B.J. 346.......		"	07 51·55		51·98	56·56	4·58		07 56·59
	32	B.J. 349.......		"	13 11·05		11·39	15·98	4·59		13 16·00
	33	1 H. Draconis.		"	24 20·13		23·36	28·03	4·67		....
	34	B.J. 358.......		"	26 47·15		47·73	52·31	......		26 52·34
	35	B.J. 368.......		"	44 32·71		33·49	38·17	......		44 38·10
	36	B.J. 374.......		"	52 06·99		07·39	12·02	4·63		52 12·00
	37	B.J. 383.......		"	10 11 36·89		37·31	41·97	4·66		10 11 41·92
	38	B.J. 386.......		"	16 54·80		55·21	59·84	4·63		16 59·82
	39	30 H. Camel..		"	20 14·54		18·38	22·83	4·45		....
	40	B.J. 390.......		"	22 37·42		37·76	42·39	4·63		22 42·37
	41	B.J. 394.......		"	24 49·35		50·04	54·74	......		24 54·65
	42	B.J. 398.......		"	29 19·33		20·05	24 70	......		29 24·66
Mar. 26	43	B.J. 383.......		S	10 11 37·46	−·081	37·78	41·91	4·13	4·14	10 11 41·92
	44	B.J. 386.......		"	16 55·37	(·421)	55·67	59·78	4·11		16 59·81
	45	30 H. Camel..		"	20 15·82		18·50	22·36	3·86		....
	46	B.J. 394.......		"	24 49·97		50·42	54·66	......		24 54·56
	47	B.J. 398.......		"	29 19·93		20·40	24·63	......		29 24·54
	48	37 Leo. Min..		"	33 36·46		36·66	......	......		33 40·80

Clamp West. Adopted clock-rate zero.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T + m$	Adopted $\Delta T + m$	App. R. A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Mar. 26	1	B.J. 407.......		S	10 40 48·77	—·081	48·96	53·11	4·15	4·14	10 40 53·10
	2	B.J. 412.......		"	48 13·94	(·421)	14·16	18·32	4·16		48 18·30
	3	47 Urs. Maj...		"	54 22·98		23·27	.....	......		54 27·41
	4	B.J. 416.......		"	56 22·72		23·17	27·44	......		56 27·31
	5	B.J. 420.......		"	11 04 33·78		34·05	38·27	4·22		11 04 38·19
	6	B.J. 424.......		"	11 35·39		35·73	39·83	......		11 39·87
	7	B.J. 425.......		"	13 34·38		34·59	38·67	4·08		13 38·73
	8	39 H. Cephei..	L.C.	"	27 21·09		14·79	18·04	3·25		....
	9	B.J. 441.......		"	41 15·62		15·93	20·15	......		41 20·07
	10	B.J. 447.......		"	49 03·84		04·24	08·49	......		49 08·38
	11	1 Can. Ven....		"	12 10 13·80		14·20	.....	......		12 10 18·34
	12	B.J. 458.......		"	11 34·44		34·73	38·91	4·18		11 38·87
	13	Bradley 1672..		"	15 01·57		12·12	16·57	4·45		....
	14	B.J. 461.......		"	21 22·33		22·59	26·76	4·17		21 26·73
	15	B.J. 467.......		"	25 43·58		44·08	48·13	......		25 48·22
	16	B.J. 470.......		"	29 25·51		25·81	30·05	4·24		29 29·95
	17	32² H. Camel.		"	48 34·77		37·84	42·07	4·23		....
	18	43 H. Cephei..	L.C.	"	55 54·66		49·90	54·37	4·47		....
Apr. 2	19	B.A.C. 7504...	L.C.	S	9 17 23·45	—·091	17·67	22·08	4·41	3·50	....
	20	1 H. Draconis.		"	24 20·78	(·415)	22·92	26·65	3·73		....
	21	B.J. 358.......		"	26 48·10		48·44	52·04	......		9 26 51·94
	22	B.J. 360.......		"	28 40·07		40·29	43·83	3·54		28 43·79
	23	B.J. 368.......		"	44 33·81		34·30	37·88	......		44 37·80
	24	B.J. 374.......		"	52 08·05		08·33	11·86	3·53		52 11·83
	25	B.J. 383.......		"	10 11 38·12		38·41	41·84	3·43		10 11 41·91
	26	30 H. Camel..		"	20 15·62		18·16	21·66	3·50		....
	27	B.J. 398.......		"	29 20·51		20·95	24·53	......		29 24·45
	28	37 Leo. Min...		"	33 37·10		37·29	.....	......		33 40·79
	29	B.J. 420.......		"	11 04 34·38		34·64	38·23	3·59		11 04 38·14
	30	B.J. 424.......		"	11 35·96		36·27	39·80	......		11 39·77
	31	B.J. 425.......		"	13 34·95		35·14	38·66	3·52		13 38·64
	32	39 H. Cephei..	L.C.	"	27 21·96		15·92	19·07	3·15		....
	33	B.J. 441.......		"	41 16·21		16·51	20·14	......		41 20·01
	34	Groom. 1830..		"	47 45·62		45·86	.....	......		47 49·36
	35	B.J. 467.......		"	12 25 44·23		44·70	48·17	......		12 25 48·20
	36	B.J. 470.......		"	29 26·27		26·55	30·09	3·54		29 30·05
	37	B.J. 483.......		"	50 03·04		03·46	07·03	......		50 06·96
Apr. 3	38	B.J. 368.......		S	9 44 33·35	·075	34·27	37·86	......	3·60	9 44 37·87
	39	B.J. 374.......		"	52 07·68	(·488)	08·24	11·84	3·60		52 11·84
	40	B.J. 383.......		"	10 11 37·62		38·21	41·82	3·61		10 11 41·81
	41	B.A.C. 3495...		"	16 46·34		52·00	55·81	3·81		....
	42	30 H. Camel..		"	20 13·83		18·11	21·59	3·48		....
	43	B.J. 390.......		"	22 38·13		38·62	42·27	3·65		22 42·22
	44	B.J. 394.......		"	24 50·03		50·86	54·54	......		24 54·46
	45	B.J. 398.......		"	29 19·97		20·83	24·51	......		29 24·43
	46	37 Leo. Min...		"	33 36·73		37·15	.....	......		33 40·75
	47	B.J. 407.......		"	40 49·04		49·44	53·06	3·62		40 53·04
	48	B.J. 412.......		"	48 14·24		14·70	18·27	3·57		48 18·30

From March 26 Clamp West: from April 3 Clamp East. Adopted clock-rate zero.
5,29. Observed facing north.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T + m$	Adopted $\Delta T + m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Apr 3	1	47 Ursæ Maj..		S	10 54 23·12	·075	23·67	.....	....	3·60	10 54 27·27
	2	B.J. 416.......		"	56 22·89	(·488)	23·73	27·37	....		56 27·33
	3	B.J. 420.......		"	11 04 34·01		34·57	38·22	3·65		11 04 38·17
	4	B.J. 424.......		"	11 35·47		36·13	39·79	......		11 39·73
	5	39 H. Cephei..	L.C.	"	27 25·32		15·61	19·18	3·57		....
Apr. 8	6	B.J. 456.......		N	12 11 15·16	·108	16·15	01·28	....	−14·88	12 11 01·27
	7	Bradley 1672..		"	15 11·01	(·512)	30·19	15·39	−14·80		....
	8	B.J. 461.......		"	21 41·12		41·68	26·81	−14·87		21 26·80
	9	B.J. 467.......		"	26 02·03		03·08	48·17	......		25 48.20
	10	B.J. 470.......		"	29 44·30		44.90	30·10	−14·80		29 30·02
	11	32[2] H. Camel..		"	48 51·17		56·83	42·15	−14·68		....
	12	B.J.485........		"	52 05·28		05·83	50·94	−14·89		51 50·95
	13	43 H. Cephei..	L.C.	"	56 16·70		08·92	54·37	−14·55		....
	14	19 Can. Ven...		"	13 11 45·31		45.90	.....	....		13 11 31·02
	15	B.J. 494.......		"	13 46·66		47·25	32·37	−14·88		13 32·37
	16	23 Can. Ven...		"	16 33·14		33·72	.....	....		16 18·84
	17	B.J. 497.......		"	20 34·78		35·70	20·83	....		20 20·82
	18	α Urs. Min....	L.C.	"	26 20·53		52·43	37·74	−14·69		....
	19	25 Can. Ven...		"	33 43·84		44·35	.....	....		33 29·47
	20	B.J. 509.......		"	44 16·06		16·82	01·96	....		44 01·94
	21	B.J. 527.......		"	14 13 13·94		14·63	59·77	....		14 12 59·75
Apr. 10	22	B.A.C. 7504...	L.C.	S	9 17 49·17	·098	39·03	24·47	−14·56	−14·92	....
	23	1 H. Draconis.		"	24 36·70	(·516)	40·66	25·76	−14·90		....
	24	B.J. 358.......		"	27 06·02		06·80	51·87	....		9 26 51·88
	25	B.J. 360.......		"	28 58·11		58·65	43·72	−14·93		28 43·73
	26	B.J. 368.......		"	44 51·60		52·62	37·68	....		44 37·70
	27	B.J. 374.......		"	52 26·05		26·66	11·74	−14·92		52 11·74
	28	B.J. 383.......		"	10 11 56·01		56·65	41·73	−14·92		10 11 41·73
	29	B.A.C. 3495...		"	17 03·53		09·74	54·80	−14·94		....
	30	30 H. Camel..		"	20 31·14		35·83	20·84	−14·99		....
	31	B.J. 390.......		"	22 56·58		57·12	42·20	−14·92		22 42·20
	32	B.J. 394.......		"	25 08·44		09·35	54·41	....		24 54·43
	33	B.J. 398.......		"	29 38·34		39·28	24·39	....		29 24·36
	34	37 Leo. Min...		"	33 55·15		55·62	.....	....		33 40·70
	35	B.J. 407.......		"	41 07·46		07·91	53·01	−14·90		40 52·99
	36	B.J. 412.......		"	48 32·57		33·07	18·22	−14·85		48 18·15
	37	B.J. 416.......		"	56 41·27		42·19	27·28	....		56 27·27
	38	B.J. 420.......		"	11 04 52·40		53·02	38·17	−14·85		11 04 38·10
	39	B.J. 424.......		"	11 53·95		54·67	39·73	....		11 39·75
	40	39 H. Cephei..	L.C.	"	27 46·37		35·76	20·26	−15·50		....
Apr. 11	41	1 H. Draconis.		N	9 24 38·29	·092	42·57	25·63	−16·94	−16·84	....
	42	B.J. 358.......		"	27 07·85	(·545)	08·69	51·85	....		9 26 51·85
	43	B.J. 360.......		"	29 00·00		00·52	43·70	−16·82		28 43·68
	44	B.J. 368.......		"	44 53·36		54·46	37·65	....		44 37·62
	45	B.J. 374.......		"	52 27·96		28·56	11·72	−16·84		52 11·72
	46	B.J. 383.......		"	10 11 57·89		58·52	41·71	−16·81		10 11 41·68
	47	B.A.C. 3495...		"	17 04·41		11.11	54·61	−16·50		....

Clamp East. Adopted clock-rate zero.

3,38. Observed facing north.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit.	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation.
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Apr. 11	1	30 H. Camel..		N	10 20 32·51	·092	37·59	20·69	−16·90	−16·84	....
	2	B.J. 390.......		"	22 58·45	(·545)	58·97	42·18	−16·79		10 22 42·13
	3	B.J. 394.......		"	25 10·26		11·24	54·39	....		24 54·40
	4	B.J. 398.......		"	29 40·23		41·25	24·37	....		29 24·41
	5	B.J. 407.......		"	41 09·43		09·86	53·00	−16·86		40 53·02
	6	B.J. 412.......		"	48 34·54		35·03	18·21	−16·82		48 18·19
	7	47 Urs. Maj...		"	54 43·49		44·08	.....	....		54 27·24
	8	B.J. 416.......		"	56 43·11		44·10	27·26	....		56 27·26
	9	B.J. 420.......		"	11 04 54·34		55·02	38·15	−16·87		11 04 38·18
	10	B.J. 424.......		"	11 55·86		56.65	39·71	....		11 39·81
	11	B.J. 425.......		"	13 54·93		55·40	38·61	−16·79		13 38·56
	12	39 H. Cephei..	L.C.	"	27 47·79		37·17	20·50	−16·67		....
Apr. 12	13	Groom. 1830..		N	11 48 05·59	·113	06·16	.....	....	−16·70	11 47 49·46
	14	B.J. 447.		"	49 24·17	(·541)	25·11	08·43	....		49 08·41
	15	B.J. 456.......		"	12 11 16·72		17·77	01·26	....		12 11 01·07
	16	Bradley 1672..		"	15 09·04		29·28	14·25	−15·03		....
	17	B.J. 461.......		"	21 42·89		43·47	26·80	−16·67		21 26·77
	18	B.J. 467.......		"	26 03·75		04·86	48·15	....		25 48·16
	19	B.J. 470.......		"	29 46·15		46·79	30·10	−16·69		29 30·09
	20	9 Can. Ven....		"	34 44·39		45·02	.....	....		34 28·32
	21	32² H. Camel..		"	48 52·62		58·59	42·04	−16·55		....
	22	B.J. 485.......		"	52 07·09		07·66	50·95	−16·71		51 50·96
	23	43 H. Cephei..	L.C.	"	56 19·13		10·89	54·68	−16·21		....
	24	14 Can. Ven...		"	13 01 49·93		50·47	.....	....		13 01 33·77
	25	B.J. 491.......		"	06 13·27		13·85	57·15	−16·70		05 57·15
	26	19 Can. Ven...		"	11 47·18		47·81	.....	....		11 31·11
	27	B.J. 494.......		"	13 48·43		49·05	32·39	−16·66		13 32·35
	28	23 Can. Ven...		"	16 34·98		35·60	.....	....		16 18·90
	29	B.J. 497.......		"	20 36·54		37·51	20·85	....		20 20·81
	30	α Urs. Min....	L.C.	"	26 22·80		53·07	38·23	−14·84		....
	31	25 Can. Ven...		"	33 45·77		46·32	.....	....		33 29·62
Apr. 13	32	B.J. 383.......		S	10 11 45·82	·089	46·50	41·68	− 4·82	−4·81	10 11 41·69
	33	B.A.C. 3495...		"	16 52·30	(·567)	58·96	54·25	− 4·71		....
	34	30 H. Camel..		"	20 20·25		25·28	20·43	− 4·85		....
	35	B.J. 390.......		"	22 46·41		46·98	42·16	− 4·82		22 42·17
	36	B.J. 394.......		"	24 58·16		59·13	54·35	....		24 54·32
	37	B.J. 398.......		"	29 28·07		29·07	24·33	....		29 24·26
	38	37 Leo. Min...		"	33 44·97		45·46	.....	....		33 40·65
	39	B.J. 407.......		"	40 57·25		57·72	52·97	− 4·75		40 52·91
	40	B.J. 412.......		"	48 22·45		22·97	18·18	− 4·79		48 18·16
	41	47 Urs. Maj...		"	54 31·34		31·98	.....	....		54 27·17
	42	B.J. 416.......		"	56 31·02		32·00	27·22	....		56 27·19
	43	B.J. 420.......		"	11 04 42·27		42·93	38·13	− 4·80		11 04 38·12
Apr. 14	44	B.A.C. 7504...	L.C.	S	9 17 57·29	·082	46·46	25·81	−20·65	−21·12	....
	45	1 H. Draconis.		"	24 41·95	(·572)	46·18	25·26	−20·92		....
	46	B.J. 358.......		"	27 12·07		12·89	51·78	....		9 26 51·77
	47	B.J. 360.......		"	29 04·16		04·72	43·65	−21·07		28 43·60

Clamp East. Adopted clock-rate zero.

43. Observed facing north.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date.	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Apr. 14	1	B.J. 368.......		S	9 44 57·57	·082	58·64	37·57	....	−21·12	9 44 37·52
	2	B.J. 374.......		"	52 32·07	(·572)	32·71	11·67	−21·04		52 11·59
	3	B.J. 383.......		"	10 12 02·15		02·83	41·66	−21·17		10 11 41·71
	4	B.A.C. 3495...		"	17 08·79		15·43	54·09	−21·34		....
	5	B.J. 398.......		"	29 44·39		45·39	24·31	....		29 24·27
	6	37 Leo. Min...		"	34 01·30		01·79	.....	....		33 40·67
	7	B.J. 407.......		"	41 13·58		14·04	52·96	−21·08		40 52·92
	8	B.J. 412.......		"	48 38·77		39·28	18·17	−21·11		48 18·16
	9	B.J. 416.......		"	56 47·31		48·28	27·20	....		56 27·16
	10	B.J. 420.......		"	11 04 58·56		59·21	38·12	−21·09		11 04 38·09
	11	B.J. 424.......		"	12 00·05		00·82	39·67	....		11 39·70
	12	B.J. 425.......		"	13 59·21		59·71	38·59	−21·12		13 38·59
	13	39 H. Cephei..	L.C.	"	27 54·00		42·67	21·22	−21·45		....
Apr. 21	14	B.A.C. 7504...	L.C.	N	9 17 39·52	·097	29·81	28·01	− 1·80	−1·79	....
	15	1 H. Draconis.		"	24 22·01	(·515)	26·11	24·45	− 1·66		....
	16	B.J. 358.......		"	26 52·49		53·30	51·61	....		9 26 51·51
	17	B.J. 360.......		"	28 44·79		45·30	43·53	− 1·77		28 43·51
	18	B.J. 368.......		"	44 38·08		39·14	37·36	....		44 37·35
	19	B.J. 374.......		"	52 12·72		13·30	11·55	− 1·75		52 11·51
	20	B.J. 383.......		"	10 11 42·72		43·33	41·55	− 1·78		10 11 41·54
	21	B.A.C. 3495...		"	16 48·03		54·46	52·98	− 1·48		....
	22	30 H. Camel..		"	20 16·70		21·57	19·49	− 2·08		....
	23	B.J. 390.......		"	22 43·31		43·82	42·05	− 1·77		22 42·03
	24	B.J. 394.......		"	24 54·87		55·82	54·17	....		24 54·03
	25	B.J. 398.......		"	29 24·87		25·85	24·15	....		29 24·06
	26	37 Leo. Min...		"	33 41·86		42·30	.....	....		35 40·51
	27	B.J. 412.......		"	48 19·43		19 90	18·09	− 1·81		48 18·11
	28	47 Ursae Maj..		"	54 28·33		28·91	.....	....		54 27·12
	29	B.J. 416.......		"	56 27·89		28·85	27·06	....		56 27·06
	30	B.J. 420.......		"	11 04 39·16		39·80	38·03	− 1·77		11 04 38·01
	31	B.J. 425.......		"	13 39·82		40·27	38·53	− 1·74		13 38·48
Apr. 22	32	1 H.Draconis..		N	9 24 23·95	− ·129	26·20	24·31	− 1·89	−1·82	....
	33	B.J. 358.......		"	26 52·95	(·448)	53·31	51·58	....		9 26 51·49
	34	B.J. 360.......		"	28 45·09		45·27	43·51	− 1·76		28 43·45
	35	B.J. 374.......		"	52 13·08		13·30	11·53	− 1·77		52 11·48
	36	B.J. 383.......		"	10 11 43·13		43·37	41·53	− 1·84		10 11 41·55
	37	B.A.C. 3495...		"	16 51·03		54·60	52·78	− 1·82		....
	38	30 H. Camel..		"	20 18·67		21·36	19·34	− 2·02		....
	39	B.J. 390.......		"	22 43·66		43·84	42·04	− 1·80		22 42·02
	40	B.J. 394.......		"	24 55·48		55·92	54·15	....		24 54·10
	41	B.J. 398.......		"	29 25·40		25·86	24·12	....		29 24·04
	42	37 Leo. Min...		"	33 42·22		42·36	.....	....		33 40·54
	43	B.J. 407.......		"	40 54·54		54·66	52·87	− 1·79		40 52·84
	44	B.J. 412.......		"	48 19·75		19·90	18·08	− 1·82		48 18·08
	45	47 Urs. Maj...		"	54 28·75		28·97	.....	....		54 27·15
	46	B.J. 416.......		"	56 28·41		28·85	27·04	....		56 27·03
	47	B.J. 420.......		"	11 04 39·57		39·84	38·02	− 1·82		11 04 38·02
	48	B.J. 424.......		"	11 41·03		41·36	39·56	....		11 39·54

From April 14 Clamp East: from April 22 Clamp West. 1−13. Adopted clock-rate zero. 14−31. Adopted $\Delta T+m=-1{\cdot}789+{\cdot}0028$ (T−10h. 20m.) 32−48. Adopted $\Delta T+m=-1{\cdot}821+{\cdot}0028$ (T−10h. 20m.) 10. Observed facing north.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Apr. 22	1	B.J. 425.......		N	11 13 40·20	−·129	40·35	38·52	−1·83	−1·82	11 13 38·53
	2	39 H. Cephei..	L.C.	"	27 31·24	(·448)	25·72	22·96	−2·76		....
Apr. 25	3	30 H.Camel...		S	10 20 18·38	−·141	20·36	18·86	−1·50	−1·49	....
	4	B.J. 390.......		"	22 43·31	(·397)	43·46	41·99	−1·47		10 22 41·97
	5	B.J. 394.......		"	24 55·27		55·57	54·07	....		24 54·08
	6	B.J. 398.......		"	29 25·21		25·52	24·04	....		29 24·03
	7	37 Leo. Min...		"	33 41·90		42·01	....	....		33 40·52
	8	B.J. 407.......		"	40 54·22		54·32	52·84	−1·48		40 52·83
	9	B.J. 412.......		"	48 19·39		19·52	18·04	−1·48		48 18·03
	10	47 Urs. Maj...		"	54 28·36		28·55	....	....		54 27·06
	11	B.J. 416.......		"	56 28·13		28·44	26·97	....		56 26·95
	12	B.J. 420.......		"	11 04 39·22		39·39	37·97	−1·42		11 04 37·90
	13	B.J. 424.......		"	11 40·85		41·06	39·51	....		11 39·57
	14	B.J. 425.......		"	13 39·90		40·02	38·48	−1·54		13 38·53
	15	39 H. Cephei..	L.C.	"	27 30·34		25·52	23·86	−1·66		....
	16	B.J. 441.......		"	41 21·22		21·41	19·94	....		41 19·92
	17	Groom. 1830..		"	47 50·65		50·81	....	....		47 49·32
	18	B.J. 447.......		"	49 09·46		09·73	08·26	....		49 08·24
	19	B.J. 458.......		"	12 11 40·12		40·31	38·86	−1·45		12 11 38·82
	20	Bradley 1672..		"	15 04·29		12·15	10·46	−1·69		....
Apr. 27	21	B.J. 441.......		S	11 41 21·02	−·162	21·21	19·92	....	−1·30	11 41 19·91
	22	Groom. 1830..		"	47 50·51	(·417)	50·66	....	....		47 49·36
	23	B.J. 447.......		"	49 09·25		09·51	08·23	....		49 08·21
	24	1 Can. Ven....		"	12 10 19·26		19·51	....	....	−1·29	12 10 18·22
	25	B.J. 458.......		"	11 39·94		40·11	38·84	−1·27		11 38·82
	26	Bradley 1672..		"	15 03·64		11·47	09·54	−1·93		....
	27	B.J. 461.......		"	21 27·88		28·04	26·74	−1·30		21 26·75
	28	B.J. 467.......		"	25 49·04		49·37	48·01	....		25 48·08
	29	B.J. 470.......		"	29 31·10		31·29	30·04	−1·25		29 30·00
	30	9 Can. Ven....		"	34 29·36		29·54	....	....		34 28·25
	31	32² H. Camel..		"	48 39·89		42·15	41·13	−1·02		....
	32	B.J. 485.......		"	51 52·11		52·26	50·94	−1·32		51·50·97
	33	43 H. Cephei..	L.C.	"	56 01·21		57·59	56·17	−1·42		....
	34	14 Can. Ven...		"	13 01 34·93		35·06	....	....		13 01 33·77
	35	B.J. 491.......		"	05 58·27		58·43	57·16	−1·27		05 57·14
	36	19 Can. Ven...		"	11 32·25		32·43	....	....		11 31·14
	37	B.J. 494.......		"	13 33·47		33·64	32·41	−1·23		13 32·35
	38	23 Can. Ven..		"	16 20·04		20·22	....	....		16 18·93
	39	B.J. 497.......		"	20 21·80		22·07	20·85	....		20 20·78
	40	α Urs. Min...	L.C.	"	25 54·81		41·80	41·50	− ·30		....
Apr. 28	41	B.J. 352.......		N	9 15 36·07	−·141	36·23	34·99	−1·24	−1·18	9 15 35·05
	42	1 H.Draconis..		"	24 22·35	(·472)	24·69	23·47	−1·22		....
	43	B.J. 358.......		"	26 52·32		52·69	51·43	....		26 51·51
	44	B.J. 360.......		"	28 44·39		44·56	43·41	−1·15		28 43·38
	45	B.J. 368.......		"	44 37·81		38·33	37·15	....		44 37·15
	46	B.J. 374.......		"	52 12·37		12·60	11·43	−1·17		52 11·42
	47	B.J. 383.......		"	10 11 42·36		42·60	41·42	−1·18		10 11 41·42

Clamp West. 1, 2. Adopted $\Delta T+m=-1{\cdot}821+{\cdot}0028\ (T-10^h\ 20^m)$.

3−20. Adopted $\Delta T+m=-1{\cdot}490+{\cdot}0028\ (T-11^h\ 15^m)$.

21−40. Adopted $\Delta T+m=-1{\cdot}293+{\cdot}0028\ (T-12^h\ 45^m)$.

41−47. Adopted $\Delta T+m=-1{\cdot}180+{\cdot}0028\ (T-10^h\ 15^m)$. 12. Observed facing north.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910			.		h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Apr. 28	1	B.A.C. 3495...		N	10 16 48·98	−·141	52·68	51·51	−1·17	−1·18	....
	2	30 H. Camel..		"	20 17·03	(·472)	19·81	18·40	−1·41		....
	3	B.J. 390......		"	22 42·85		43·03	41·95	−1·08		10 22 41·85
	4	B.J. 394		"	24 54·65		55·10	54·00	....		24 53·92
	5	B.J. 398.......		"	29 24·53		25·01	23·97	....		29 23·83
	6	37 Leo. Min...		"	33 41·48		41·61	.....	....		33 40·43
	7	B.J. 407.......		"	40 53·89		54·01	52·80	−1·21		40 52·83
	8	B.J. 412.......		"	48 19·03		19·19	18·00	−1·19		48 18·01
	9	47 Urs. Maj...		"	54 28·00		28·22	.....	....		54 27·04
	10	B.J. 416.......		"	56 27·63		28·09	26·91	....		56 26·91
	11	B.J. 420.......		"	11 04 38·81		39·08	37·93	−1·15		11 04 37·90
	12	B.J. 424.......		"	11 40·41		40·75	39·46	....		11 39·57
	13	B.J. 425.......		"	13 39·41		39·55	38·45	−1·10		13 38·37
	14	39 H.Cephei...	L.C.	"	27 32·58		26·83	24·80	−2·03		....
Apr. 30	15	B.J. 379.......		S	10 02 27·44	−·162	27·46	26·23	−1·23	−1·17	10 02 26·29
	16	B.J. 384.......		"	11 43·03	(·478)	43·09	41·92	−1·17		11 41·92
	17	B.J. 386.......		"	17 00·23		00·47	59·30	−1·17		16 59·30
	18	30 H. Camel..		"	20 16·82		19·30	18·14	−1·16		....
	19	B.J. 390.......		"	22 42·90		43·09	41·92	−1·17		22 41·92
	20	B.J. 394.......		"	24 54·77		55·15	53·95	....		24 53·98
	21	37 Leo. Min...		"	33 41·48		41·63	.....	....		33 40·46
	22	B.J. 405.......		"	38 33·44		33·50	32·34	−1·16		38 32·33
	23	B.J. 407.......		"	40 53·80		53·93	52·78	−1·15		40 52·76
	24	B.J. 412.......		"	48 18·99		19·15	17·98	−1·17		48 17·98
	25	54 Leonis.....		"	50 46·57		46·64	.....	....		50 45·47
	26	47 Urs. Maj...		"	54 27·89		28·13	.....	....		54 26·96
	27	B.J. 416.......		"	56 27·56		27·95	26·86	....		56 26·78
	28	B.J. 420.......		"	11 04 38·76		39·04	37·90	−1·14		11 04 37·87
	29	B.J. 422.......		"	09 21·52		21·56	20·41	−1·15		09 20·39
	30	B.J. 424.......		"	11 40·30		40·58	39·43	....		11 39·41
	31	B.J. 425.......		"	13 39·40		39·55	38·43	−1·12		13 38·38
	32	B.J. 432.......		"	25 41·48		41·74	40·66	−1·08		25 40·57
	33	B.J. 441.......		"	41 20·76		21·02	19·88	....		41 19·85
	34	B.J. 444.......		"	44 30·42		30·42	29·26	−1·16		44 29·25
	35	31 Comae.....		"	12 47 21·50		21·60	.....	....		12 47 20·43
	36	B.J. 485.......		"	51 51·93		52·13	50·93	−1·20		51 50·96
	37	43 H. Cephei..	L.C.	"	56 02·04		57·59	56·59	−1·00		....
	38	14 Can. Ven...		"	13 01 34·70		34·88	.....	....		13 01 33·71
	39	B.J. 492.......		"	07 43·05		43·15	42·00	−1·15		07 41·98
	40	19 Can. Ven...		"	11 32·09		32·32	.....	....		11 31·15
	41	B.J. 494.......		"	13 33·29		33·52	32·41	−1·11	−1·16	13 32·36
	42	23 Can. Ven...		"	16 19·87		20·10	.....	....		16 18·94
	43	B.J. 497.......		"	20 21·61		21·97	20·84	......		20 20·81
	44	α Urs. Min....	L.C.	"	26 00·32		44·33	42·62	−1·71		....
	45	B.J. 502.......		"	30 49·55		49·74	48·57	−1·17		30 48·58
	46	25 Can. Ven...		"	33 30·61		30·80	.....	....		33 29·64
	47	B.J. 507.......		"	42 01·73		01·74	00·55	−1·19		42 00·58
	48	B.J. 509.......		"	43 02·87		03·14	02·06	....		43 01·98

Clamp West. 1−14. Adopted $\Delta T+m=-1\cdot180+\cdot0028\ (T-10^{h}\ 15^{m})$.
15−48. Adopted $\Delta T+m=-1\cdot169+\cdot0029\ (T-11^{h}\ 50^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 3	1	54 Leonis.....		N	10 50 46·32	−·139	46·41	.....	.....	−0·98	10 50 45·43
	2	47 Urs. Maj...		"	54 27·68	(·515)	27·95	.....	.....		54 26·97
	3	B.J. 416.......		"	56 27·32		27·85	26·79	.....		56 26·87
	4	B.J. 420.......		"	11 04 38·52		38·84	37·84	−1·00		11 04 37·86
	5	B.J. 422.......		"	09 21·28		21·34	20·37	− ·97		09 20·36
	6	B.J. 424.......		"	11 40·04		40·43	39·37	.....		11 39·45
	7	B.J. 425.......		"	13 39·20		39·37	38·39	− ·98		13 38·39
	8	39 H. Cephei..	L.C.	"	27 33·59		27·02	26·13	− ·89		.....
	9	Groom. 1830..		"	47 50·08		50·31	.....	.....		47 49·33
	10	*o* Leonis.......		"	51 04·95		04·96	.....	.....		51 03·98
	11	1 Can. Ven....		"	12 10 18·60		19·07	.....	.....		12 10 18·09
	12	B.J. 458.......		"	11 39·43		39·69	38·79	− ·90		11 38·71
	13	Bradley 1672..		"	14 55·72		08·15	07·32	− ·83		.....
	14	B.J. 461.......		"	21 27·42		27·66	26·69	− ·97		21 26·68
	15	15 Comae.....		"	22 29·47		29·59	.....	.....		22 28·61
	16	B.J. 470.......		"	29 30·68		30·95	29·99	− ·96		29 29·97
	17	23 Comae.....		"	30 24·31		24·39	.....	.....		30 23·41
	18	9 Can. Ven....		"	34 28·98		29·24	.....	.....		34 28·26
May 5	19	B.J. 444.......		S	11 44 29·93	−·167	29·94	29·22	− ·72	− ·74	11 44 29·20
	20	Groom. 1830..		"	47 49·67	(·538)	49·91	.....	.....		47 49·17
	21	*o* Leonis.......		"	51 04·63		04·65	.....	.....		51 03·91
	22	1 Can. Ven....		"	12 10 18·25		18·65	.....	.....		12 10 17·91
	23	B.J. 458.......		"	11 39·19		39·47	38·77	− ·70		11 38·73
	24	Bradley 1672..		"	14 55·18		06·72	06·51	− ·21		.....
	25	12 Comae.....		"	18 00·92		01·03	.....	.....		12 18 00·29
	26	B.J. 461.......		"	21 27·11		27·36	26·67	− ·69		21 26·62
	27	15 Comae.....		"	22 29·25		29·39	.....	.....		22 28·65
	28	B.J. 466.......		"	25 13·97		14·03	13·32	− ·71		25 13·29
	29	B.J. 470.......		"	29 30·38		30·67	29·97	− ·70		29 29·93
	30	23 Comae.....		"	30 24·00		24·08	.....	.....		30 23·34
	31	9 Can. Ven....		"	34 28·69		28·97	.....	.....		34 28·23
	32	31 Comae.....		"	47 21·09		21·22	.....	.....		47 20·48
	33	B.J. 483.......		"	50 07·01		07·47	06·88	.....		50 06·73
	34	B.J. 485.......		"	51 51·39		51·63	50·89	− ·74		51 50·89
	35	43 H. Cephei..	L.C.	"	56 02·94		57·75	57·27	− ·48		.....
	36	14 Can. Ven...		"	13 01 34·25		34·46	.....	.....		13 01 33·72
	37	B.J. 491.......		"	05 57·57		57·81	57·13	− ·68		05 57·07
	38	B.J. 492.......		"	07 42·59		42·72	41·98	− ·74		07 41·98
	39	19 Can. Ven...		"	11 31·58		31·86	.....	.....		11 31·12
	40	B.J. 494.......		"	13 32·83		33·11	32·38	− ·73		13 32·37
	41	23 Can. Ven...		"	16 19·33		19·60	.....	.....		16 18·86
	42	B.J. 497.......		"	20 21·03		21·47	20·79	.....		20 20·73
	43	α Urs. Min....	L.C.	"	26 03·74		45·07	44·42	− ·65		.....
	44	81 Urs. Maj...		"	30 42·59		43·04	.....	.....		30 42·30
	45	25 Can. Ven...		"	33 30·04		30·26	.....	.....		33 29·52
	46	B.J. 507.......		"	43 01·24		01·27	00·56	− ·71		43 00·53
	47	B.J. 509.......		"	44 02·37		02·71	02·04	.....		44 01·97
	48	B.J. 513.......		"	50 26·16		26·20	25·43	− ·77		50 25·46
	49	9 H.Boötis....		"	14 04 22·41		22·74	.....	.....		14 04 22·00

Clamp West. 1−18. Adopted $\Delta T+m=-\cdot982+\cdot0029\ (T-11^{h}\ 45^{m})$.

19−49 Adopted $\Delta T+m=-\cdot738+\cdot0030\ (T-13^{h}\ 05^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 5	1	B.J. 522.......		S	14 06 19·91	−·167	20·02	19·29	−·73	−·73	14 06 19·29
	2	B.J. 526.......		"	11 35·59	(·538)	35·64	34·83	−·81		11 34·91
	3	B.J. 527.......		"	13 00·32		00·61	59·97	....		12 59·88
	4	*f* Boötis......		"	22 18·35		18·40	.....	....		22 17·67
	5	204 B. Boötis..		"	26 06·45		06·74	.....	....		26 06·01
	6	B.J. 534.......		"	27 59·42		59·58	58·81	−·77		27 58·85
May 6	7	32² H. Camel.		N	12 48 37·50	−·160	40·66	40·23	−·43	−·70	....
	8	B.J. 485.......		"	51 51·45	(·487)	51·63	50·89	−·74		12 51 50·93
	9	43 H. Cephei..	L.C.	"	56 02·19		57·91	57·45	−·46		....
	10	14 Can. Ven...		"	13 01 34·25		34·41	.....	....		13 01 33·71
	11	B.J. 491.......		"	05 57·66		57·84	57·14	−·70		05 57·14
	12	B.J. 492.......		"	07 42·50		42·58	41·98	−·60		07 41·88
	13	19 Can. Ven...		"	11 31·56		31·78	.....	....		11 31·08
	14	B.J. 494.......		"	13 32·81		33·02	32·38	−·64		13 32·32
	15	B.J. 497.......		"	20 21·08		21·51	20·78	....		20 20·81
	16	α Urs. Min....	L.C.	"	26 00·26		44·86	44·93	·07		....
	17	B.J. 502.......		"	30 49·07		49·24	48·56	−·68		30 48·54
	18	25 Can. Ven...		"	33 30·12		30·29	.....	....		33 29·59
	19	B.J. 507.......		"	43 01·26		01·62	00·56	−·70		43 00·56
	20	B.J. 509.......		"	44 02·31		02·63	02·04	....		44 01·93
	21	B.J. 513.......		"	50 26·14		26·15	25·43	−·72		50 25·45
	22	B.J. 526.......		"	14 11 35·56		35·58	34·84	−·74		14 11 34·88
	23	B.J. 527.......		"	13 00·41		00·69	59·97	....		12 59·99
	24	*f* Boötis......		"	22 18·39		18·41	.....	....		22 17·71
	25	204 B. Boötis..		"	26 06·54		06·76	.....	....		26 06·06
	26	B.J. 534.......		"	27 59·38		59·49	58·81	−·68		27 58·79
	27	σ Boötis......		"	30 48·03		48·13	.....	....		30 47·43
	28	B.J. 540.......		"	35 31·85		32·10	31·40	−·70		35 31·40
May 7	29	B.J. 422.......		S	11 09 21·03	−·174	21·08	20·33	−·75	−·76	11 09 20·32
	30	B.J. 424.......		"	11 39·72	(·526)	40·04	39·30	....		11 39·28
	31	B.J. 425.......		"	13 38·91		39·08	38·34	−·74		13 38·32
	32	B.J. 432.......		"	25 40·97		41·26	40·55	−·71		25 40·50
	33	B.J. 441.......		"	41 20·15		20·44	19·77	....		41 19·68
	34	B.J. 444.......		"	44 29·97		29·96	29·20	−·76		44 29·20
	35	Groom. 1830..		"	47 49·76		49·99	.....	....		47 49·23
	36	B.J. 447.......		"	49 08·35		08·74	08·05	....		49 07·98
	37	*o* Leonis......		"	51 04·67		04·67	.....	....		51 03·91
	38	1 Can. Ve		"	12 10 18·31		18·69	.....	....	−·75	12 10 17·94
	39	B.J. 458.......		"	11 39·17		39·43	38·74	−·69		11 38·68
	40	Bradley 1672..		"	14 54·10		05·02	05·50	·48		....
	41	12 Comae.....		"	18 00·92		01·02	.....	....		18 00·27
	42	B.J. 461.......		"	21 27·11		27·34	26·65	−·69		21 26·59
	43	B.J. 466.......		"	25 14·03		14·07	13·31	−·76		25 13·32
	44	B.J. 470.......		"	29 30·38		30·65	29·95	−·70		29 29·90
	45	9 Can. Ven....		"	34 28·77		29·03	.....	....		34 28·28
	46	31 Comae.....		"	47 20·99		21·10	.....	....		47 20·35
	47	B.J. 483.......		"	50 06·98		07·41	06·86	....		50 06·66
	48	B.J. 485.......		"	51 51·36		51·59	50·88	−·71		51 50·84

Clamp West. 1−6. Adopted $\Delta T+m=-\cdot738+\cdot0030\ (T-13^h\ 05^m)$.

7−28. Adopted $\Delta T+m=-\cdot700+\cdot0030\ (T-13^h\ 45^m)$.

29−48. Adopted $\Delta T+m=-\cdot753+\cdot0030\ (T-12^h\ 50^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 7	1	43 H. Cephei..	L.C.	S	12 56 02·86	−·174	57·93	57·66	− ·27	−·75	....
	2	14 Can. Ven...		"	13 01 34·23	(·526)	34·42	.....	....		13 01 33·67
	3	B.J. 491.......		"	05 57·62		57·85	57·12	− ·73		05 57·10
	4	B.J. 492.......		"	07 42·59		42·70	41·98	− ·72		07 41·95
	5	19 Can. Ven...		"	11 31·53		31·79	.....	....		11 31·04
	6	B.J. 494.......		"	13 32·87		33·13	32·37	− ·76		13 32·38
	7	23 Can. Ven...		"	16 19·40		19·65	.....	....		16 18·90
	8	B.J. 497.......		"	20 21·04		21·45	20·77	....		20 20·70
	9	α Urs. Min....	L.C.	"	26 03·53		45·82	45·53	− ·29		....
	10	B.J. 502.......		"	30 49·05		49·26	48·56	− ·70		30 48·51
	11	25 Can. Ven...		"	33 30·12		30·32	.....	....		33 29·57
	12	B.J. 507.......		"	43 01·35		01·37	00·56	− ·81		43 00·62
	13	B.J. 509.......		"	44 02·40		02·71	02·03	....		44 01·96
	14	B.J. 513.......		"	50 26·21		26·24	25·43	− ·81		50 25·49
	15	B.J. 517.......		"	57 07·93		08·04	07·29	− ·75		57 07·29
	16	9 H. Boötis...		"	14 04 22·52		22·83	.....	....		14 04 22·08
	17	B.J. 522.......		"	06 19·96		20·05	19·29	− ·76		06 19·30
	18	B.J. 526.......		"	11 35·62		35·66	34·85	− ·81		11 34·91
	19	B.J. 527.......		"	13 00·43		00·69	59·97	....		12 59·94
	20	*f* Boötis......		"	22 18·50		18.54	.....	....		22 17·79
	21	204 B. Boötis.		"	26 06·50		06·77	.....	....		26 06·02
	22	B.J. 534.......		"	27 59·44		59·59	58·82	− ·77		27 58·84
May 10	23	37 Leo. Min...		N	10 33 40·83	−·162	40·95	.....	....	−·65	10 33 40·30
	24	B.J. 405.......		"	38 32·80	(·490)	32·85	32·21	− ·64		38 32·20
	25	B.J. 407.......		"	40 53·19		53·29	52·64	− ·65		40 52·64
	26	B.J. 412.......		"	48 18·28		18·42	17·84	− ·58		48 17·77
	27	54 Leonis.....		"	50 45·94		46·00	.....	....		50 45·35
	28	47 Urs. Maj...		"	54 27·29		27·50	.....	....		54 26·85
	29	B.J. 416.......		"	56 26·77		27·22	26·61	....		56 26·57
	30	B.J. 420.......		"	11 04 38·08		38·34	37·73	− ·61		11 04 37·69
	31	B.J. 422.......		"	09 20·90		20·92	20·30	− ·62		09 20·27
	32	B.J. 424.......		"	11 39·59		39·92	39·24	....		11 39·27
	33	B.J. 425.......		"	13 38·93		39·06	38·30	− ·76		13 38·41
	34	39 H. Cephei..	L.C.	"	27 36·34		30·65	28·53	−2·12		....
	35	B.J. 441.......		"	41 20·01		20·31	19·73	....		41 19·66
	36	B.J. 444.......		"	44 29·85		29·82	29·18	− ·64		44 29·17
	37	Groom. 1830..		"	47 49·62		49·80	.....	....		47 49·15
	38	*o* Leonis......		"	51 04·63		04·61	.....	....	−·64	51 03·97
	39	1 Can. Ven....		"	12 10 18·18		18·57	.....	....		12 10 17·93
	40	B.J. 458.......		"	11 39·07		39·28	38·71	− ·57		11 38·64
	41	Bradley 1672..		"	14 54·23		05·12	03·75	−1·37		....
	42	B.J. 461.......		"	21 27·06		27·25	26·63	− ·62		21 26·61
	43	15 Comae.....		"	22 29·17		29·26	.....	....		22 28·62
	44	B.J. 470.......		"	29 30·36		30·58	29·93	− ·65		29 29·94
	45	23 Comae.....		"	30 24·02		24·06	.....	....		30 23·42
	46	9 Can. Ven....		"	34 28·65		28·86	.....	....		34 28·22
	47	32² H. Camel..		"	48 36·78		39·95	39·79	− ·16		....
	48	B.J. 485.......		"	51 51·25		51·43	50·86	− ·57		51 50·79
	49	43 H. Cephei..	L.C.	"	56 01·86		57·56	58·33	·77		....

Clamp West. 1−22. Adopted $\Delta T+m = -\cdot 753 + \cdot 0030\ (T - 12^h\ 50^m)$.
23−49. Adopted $\Delta T+m = -\cdot 644 + \cdot 0030\ (T - 12^h\ 10^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 10	1	14 Can. Ven...		N	13 01 34·19	−·162	34·35	......	....	−·64	13 01 33·71
	2	B.J. 491.......		"	05 57·54	(·490)	57·73	57·11	−·62		05 57·09
	3	B.J. 492.......		"	07 42·56		42·64	41·97	−·67		07 42·00
	4	19 Can. Ven...		"	11 31·56		31·77	......	....		11 31·13
	5	B.J. 494.......		"	13 32·73		32·94	32·36	−·58		13 32·30
	6	23 Can. Ven...		"	16 19·32		19·52	......	....		16 18·88
	7	B.J. 497.......		"	20 20·98		21·40	20·75	....		20 20·76
	8	α Urs. Min....	L.C.	"	26 02·89		47·46	47·56	−·10		....
	9	25 Can. Ven...		"	33 30·06		30·23	......	....		33 29·59
	10	B.J. 507.......		"	43 01·27		01·27	00·57	−·70		43 00·63
	11	B.J. 509.......		"	44 02·34		02·67	02·02	....		44 02·03
May 11	12	B.J. 432.......		S	11 25 40·76	−·196	41·05	40·49	−·56	−·64	11 25 40·41
	13	39 H. Cephei..	L.C.	"	27 36·19	(·561)	29·42	28·88	−·54		....
	14	B.J. 441.......		"	41 19·99		20·29	19·71	....		41 19·65
	15	B.J. 444.......		"	44 29·80		29·78	29·17	−·61		44 29·14
	16	Groom. 1830..		"	47 49·54		49·76	......	....		47 49·12
	17	B.J. 447.......		"	49 08·13		08·53	07·97	....		49 07·89
	18	o Leonis.......		"	51 04·55		04·54	......	....		51 03·90
	19	1 Can. Ven....		"	12 10 18·21		18·60	......	....		12 10 17·96
	20	B.J. 458.......		"	11 39·04		39·30	38·70	−·60		11 38·66
	21	Bradley 1672..		"	14 52·14		03·47	03·18	−·29		....
	22	B.J. 461.......		"	21 27·03		27·26	26·61	−·65		21 26·62
	23	15 Comae.....		"	22 29·13		29·25	......	....		22 28·61
	24	B.J. 466.......		"	25 13·87		13·91	13·28	−·63		25 13·27
	25	B.J. 470.......		"	29 30·25		30·52	29·92	−·60		29 29·88
	26	23 Comae.....		"	30 23·90		23·96	......	....		30 23·32
	27	9 Can. Ven....		"	34 28·56		28·82	......	....		34 28·18
	28	31 Comae.....		"	47 20·86		20·97	......	....		47 20·33
	29	B.J. 485.......		"	51 51·31		51·54	50·85	−·69		51 50·90
	30	43 H. Cephei..	L.C.	"	56 03·89		58·78	58·55	−·23		....
	31	14 Can. Ven...		"	13 01 34·13		34·33	......	....		13 01 33·69
	32	15 Can. Ven...		"	05 35·75		35·98	......	....		05 35·34
	33	B.J. 491.......		"	05 57·48		57·71	57·10	−·61		05 57·07
	34	B.J. 492.......		"	07 42·47		42·58	41·96	−·62		07 41·94
	35	19 Can. Ven...		"	11 31·49		31·75	......	....		11 31·11
	36	B.J. 494.......		"	13 32·68		32·93	32·35	−·58		13 32·29
	37	23 Can. Ven...		"	16 19·31		19·56	......	....		16 18·92
	38	B.J. 497.......		"	20 20·89		21·31	20·73	....		20 20·67
	39	α Urs. Min....	L.C.	"	26 06·79		48·43	48·23	−·20		....
	40	B.J. 502.......		"	30 48·97		49·18	48·54	−·64		30 48·54
	41	25 Can. Ven...		"	33 29·99		30·19	......	....		33 29·55
	42	B.J. 507.......		"	43 01·16		01·17	00·57	−·60		43 00·53
	43	B.J. 509.......		"	44 02·20		02·50	02·01	....		44 01·86
	44	B.J. 513.......		"	50 26·09		26·11	25·44	−·67		50 25·47
	45	B.J. 517.......		"	57 07·79		07·90	07·30	−·60		57 07·26
	46	9 H. Boötis...		"	14 04 22·25		22·55	......	....	−·63	14 04 21·92
	47	B.J. 522.......		"	06 19·85		19·93	19·30	−·63		06 19·30
	48	B.J. 526.......		"	11 35·52		35·54	34·86	−·68		11 34·91
	49	f Boötis......		"	22 18·33		18·35	......	....		22 17·72

Clamp West. 1−11. Adopted $\Delta T+m=-\cdot 644+\cdot 0030\ (T-12^h\ 10^m)$.
12−49. Adopted $\Delta T+m=-\cdot 637+\cdot 0031\ (T-13^h\ 25^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 11	1	204 B.Boötis		S	14 26 06·37	—·196	06·65	.....	....	—·63	14 26 06·02
	2	B.J. 534		"	27 59·29	(·561)	59·43	58·83	— ·60		27 58·80
	3	σ Boötis		"	30 47·93		48·06	.....	....		30 47·43
	4	B.J. 540		"	35 31·74		32·05	31·42	— ·63		35 31·42
	5	B.J. 543		"	36 53·24		53·21	52·54	— ·67		36 52·58
	6	34 Boötis		"	39 30·29		30·39	.....	....		39 29·76
	7	ε Boötis		"	41 05·64		05·74	.....	....		41 05·11
	8	295 B.Boötis		"	45 37·01		37·23	.....	....		45 36·60
	9	ξ Boötis		"	47 16·34		16·36	.....	....		47 15·73
	10	c Boötis		"	15 03 23·13		23·20	.....	....		15 03 22·57
	11	Groom. 2283		"	06 25·25		33·71	33·71	·00		....
	12	η Cor. Bor.		"	19 31·49		31·62	.....	....		19 30·99
	13	B.J. 568		"	21 07·78		07·99	07·33	— ·66		21 07·36
	14	B.J. 572		"	24 09·34		09·46	08·82	— ·64		24 08·83
	15	B.J. 573		"	27 44·14		44·40	43·79	— ·61		27 43·77
	16	ν^2 Boötis		"	28 36·06		36·32	.....	....		28 35·69
May 12	17	47 Urs. Maj.		N	10 54 27·27	—·176	27·52	.....	....	—·66	10 54 26·86
	18	B.J. 416		"	56 26·68	(·557)	27·21	26·56	....		56 26·55
	19	B.J. 420		"	11 04 38·03		38·34	37·69	— ·65		11 04 37·68
	20	B.J. 422		"	09 20·88		20·91	20·28	— ·63		09 20·25
	21	B.J. 424		"	11 39·42		39·80	39·20	....		11 39·14
	22	B.J. 425		"	13 38·72		38·88	38·27	— ·61	—·65	13 38·23
	23	39 H. Cephei	L.C	"	27 36·84		30·20	29·23	— ·97		....
	24	B.J. 441		"	41 19·97		20·32	19·69	....		41 19·67
	25	B.J. 444		"	44 29·83		29·81	29·16	— ·65		44 29·16
	26	Groom. 1830		"	47 49·57		49·78	.....	....		47 49·13
	27	B.J. 447		"	49 08·15		08·62	07·95	....		49 07·97
	28	o Leonis		"	51 04·56		04·55	.....	....		51 03·90
	29	1 Can. Ven.		"	12 10 18·12		18·58	.....	....		12 10 17·93
	30	B.J. 458		"	11 38·97		39·21	38·68	— ·53		11 38·56
	31	Bradley 1672		"	14 51·82		04·41	02·66	—1·75		....
	32	12 Comae		"	18 00·85		00·94	.....	....		18 00·29
	33	B.J. 461		"	21 27·03		27·26	26·60	— ·66		21 26·61
	34	15 Comae		"	22 29·18		29·29	.....	....		22 28·64
	35	B.J. 466		"	25 13·96		14·00	13·27	— ·73		25 13·35
	36	B.J. 470		"	29 30·19		30·45	29·90	— ·55		29 29·80
	37	23 Comae		"	30 23·92		23 97	.....	....		30 23·32
	38	32^2 H.Camel		"	48 36·07		39·74	39·52	— ·22		....
	39	B.J. 485		"	51 51·30		51·52	50·84	— ·68		51 50·87
	40	43 H. Cephei	L.C.	"	56 04·22		59·20	58·75	— ·45		....
	41	14 Can. Ven.		"	13 01 34·09		34·28	.....	....		13 01 33·63
	42	B.J. 491		"	05 57·47		57·69	57·09	— ·60		05 57·04
	43	B.J. 492		"	07 42·55		42·65	41·96	— ·69		07 42·00
	44	19 Can. Ven.		"	11 31·44		31·69	.....	....		11 31·04
	45	B.J. 494		"	13 32·87		33·11	32·34	— ·77		13 32·46
	46	23 Can. Ven.		"	16 19·35		19·60	.....	....		16 18·95
	47	B.J. 497		"	20 20·89		21·39	20·72	....		20 20·74
	48	α Urs. Min.	L.C.	"	26 06·61		48·59	48·89	·30		....
	49	B.J. 502		"	30 48·97		49·18	48·54	— ·64		30 48·53

Clamp West. 1–16. Adopted $\Delta T+m=-\cdot637+\cdot0031\ (T-13^h\ 25^m)$.
17–49. Adopted $\Delta T+m=-\cdot651+\cdot0031\ (T-12^h\ 30^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 12	1	25 Can. Ven...		N	13 33 29·99	−·176	30·19	......	......	−·65	13 33 29·54
	2	B.J. 507.......		"	43 01·14	(·557)	01·14	00·57	− ·57		43 00·49
	3	B.J. 509.......		"	44 02·23		02·61	02·00	......		44 01·96
	4	B.J. 513.......		"	50 26·07		26·08	25·44	− ·64		50 25·43
	5	B.J. 517.......		"	57 07·85		07·95	07·30	− ·65		57 07·30
May 15	6	B.J. 441.......		S	11 41 19·29	·000	19·85	19·64	......	−·28	11 41 19·57
	7	B.J. 444.......		"	44 29·25	(·523)	29·43	29·13	− ·30		44 29·15
	8	Groom. 1830..		"	47 48·90		49·34	......	......		47 49·06
	9	B.J. 447.......		"	49 07·40		08·09	07·89	......		49 07·81
	10	*o* Leonis.......		"	51 03·91		04·10	......	......		51 03·82
	11	1 Can. Ven....		"	12 10 17·43		18·11	......	......		12 10 17·83
	12	B.J. 458.......		"	11 38·39		38·88	38·65	− ·23		11 38·60
	13	Bradley 1672..		"	14 45·33		01·82	01·29	− ·53		......
	14	12 Comae.....		"	18 00·16		00·45	......	......		18 00·17
	15	B.J. 461.......		"	21 26·37		26·83	26·57	− ·26		21 26·55
	16	15 Comae.....		"	22 28·48		28·80	......	......		22 28·52
	17	B.J. 466.......		"	25 13·26		13·49	13·25	− ·24		25 13·21
	18	B.J. 470.......		"	29 29·64		30·14	29·87	− ·27		29 29·86
	19	9 Can. Ven....		"	34 27·92		28·41	......	......		34 28·13
	20	31 Comae.....		"	47 20·44		20·75	......	......		47 20·47
	21	B.J. 483.......		"	50 06·17		06·92	06·73	......		50 06·64
	22	B.J. 485.......		"	51 50·65		51·10	50·81	− ·29		51 50·82
	23	43 H. Cephei..	L.C.	"	56 06·30		59·08	59·32	·24		......
	24	14 Can. Ven...		"	13 01 33·57		33·98	......	......		13 01 33·70
	25	15 Can. Ven...		"	05 35·13		35·58	......	......		05 35·30
	26	B.J. 491.......		"	05 56·94		57·39	57.07	− ·32		05 57·11
	27	B.J. 492.......		"	07 41·86		42·17	41·94	− ·23		07 41·89
	28	19 Can. Ven...		"	11 30·88		31·37	......	......		11 31·09
	29	B.J. 494.......		"	13 32·12		32·60	32·32	− ·28		13 32·32
	30	23 Can. Ven...		"	16 18·67		19·15	......	......		16 18·87
	31	B.J. 497.......		"	20 20·14		20·86	20·68	......		20 20·58
	32	α Ursae Min...	L.C.	"	26 17·70		51·77	50·56	−1·21		......
	33	B.J. 502.......		"	30 48·36		48·79	48·52	− ·27		30 48·51
	34	25 Can. Ven...		"	33 29·39		29·81	......	......		33 29·53
	35	B.J 507.......		"	43 00·63		00·84	00·56	− ·28		43 00·56
	36	B.J. 509.......		"	44 01·56		02·15	01·98	......		44 01·87
	37	B.J. 513.......		"	50 25·54		25·76	25·44	− ·32		50 25·48
	38	B.J. 517.......		"	57 07·19		07·50	07·29	− ·21		57 07·22
	39	9 H. Boötis...		"	14 04 21·73		22·27	......	......	−·27	14 04 22·00
	40	B.J. 522.......		"	06 19·28		19·56	19·30	− ·26		06 19·29
	41	B.J. 526.......		"	11 35·00		35·22	34·87	− ·35		11 34·95
	42	B.J. 527.......		"	12 59·60		00·12	59·95	......		12 59·85
	43	*f* Boötis.......		"	22 17·77		17·99	......	......		22 17·72
	44	204 B. Boötis..		"	26 05·77		06·28	......	......		26 06·01
	45	B.J. 534.......		"	27 58·72		59·06	58·84	− ·22		27 58·79
	46	σ Boötis.......		"	30 47·39		47·72	......	......		30 47·45
	47	B. J. 540......		"	35 31·11		31·66	31·42	− ·24		35 31·39
	48	B. J. 543......		"	36 52·68		52·85	52·56	− ·29		36 52·58
	49	34 Boötis.....		"	39 29·69		29·99	......	......		39 29·72

Clamp West. 1−5. Adopted $\Delta T+m=-\cdot652+\cdot0031\ (T-12^h\ 30^m)$.
6−49. Adopted $\Delta T+m=-\cdot276+\cdot0031\ (T-13^h\ 40^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 15	1	ε Boötis.......		S	14 41 05·09	·000	05·39	......	......	−·27	14 41 05·12
	2	295 B.Boötis..		"	45 36·46	(·523)	36·90	......	......		45 36·63
	3	ξ Boötis......		"	47 15·69		15·90	......	......		47 15·63
	4	B.J. 551.......		"	51 59·91		00·09	59·86	−·23		51 59·82
	5	B.J. 555.......		"	58 35·15		35·63	35·38	−·25		58 35·36
	6	B.J. 557.......		"	15 00 37·03		37·33	37·06	−·27		15 00 37·06
	7	c Boötis......		"	03 22·54		22·82	......	......		03 22·55
	8	Groom. 2283..		"	06 20·79		33·00	33·29	·29		....
	9	B.J. 563.......		"	11 54·18		54·56	54·31	−·25		11 54·29
	10	η Cor. Bor....		"	19 30·90		31·24	......	......		19 30·97
	11	B.J. 568.......		"	21 07·17		07·60	07·35	−·25		21 07·33
	12	B.J. 572.......		"	24 08·77		09·09	08·85	−·24		24 08·82
	13	B.J. 573.......		"	27 43·59		44·08	43·82	−·26		27 43·81
	14	ν^2 Boötis......		"	28 35·43		35·92	......	......		28 35·65
	15	B.J. 578.......		"	30 54·38		54·68	54·34	−·34		30 54·41
	16	B.J. 580.......		"	34 37·42		37·90	37·69	−·21		34 37·63
	17	ζ Cor. Bor....		"	36 01·05		01·47	......	......		36 01·20
	18	ι Serpentis....		"	37 33·95		34·17	......	......		37 33·90
May 16	19	39 H. Cephei..	L.C.	N	11 27 39·94	·016	31·25	30·43	−·82	−·26	....
	20	B.J. 441......		"	41 19·21	(·517)	19·82	19·62	......		11 41 19·56
	21	B.J. 444.......		"	44 29·23		29·38	29·12	−·26		44 29·12
	22	Groom. 1830..		"	47 48·93		49·36	......	......		47 49·10
	23	B.J. 447.......		"	49 07·43		08·18	07·87	......		49 07·92
	24	o Leonis......		"	51 03·91		04·07	......	......		51 03·81
	25	1 Can. Ven....		"	12 10 17·27		18·01	......	......		12 10 17·75
	26	B.J. 458.......		"	11 38·34		38·81	38·63	−·18		11 38·55
	27	Bradley 1672..		"	14 43·44		59·94	00·84	.90		....
	28	12 Comae.....		"	18 00·19		00·47	......	......		18 00·21
	29	B.J. 461.......		"	21 26·28		26·72	26·55	−·17		21 26·46
	30	15 Comae.....		"	22 28·52		28·82	......	......		22 28·56
	31	B.J. 466.......		"	25 13·24		13·45	13·25	−·20		25 13·19
	32	B.J. 470.......		"	29 29·56		30·05	29·85	−·20		29 29·79
	33	23 Comae.....		"	30 23·32		23·55	......	......		30 23·29
	34	9 Can. Ven....		"	34 27·97		28·44	......	......	−·25	34 28·19
	35	32^2 H. Camel..		"	48 34·50		39·36	38·98	−·38		....
	36	B.J. 485.......		"	51 50·69		51·12	50·80	−·32		51 50·87
	37	43 H. Cephei..	L.C.	"	56 05·69		59·13	59·49	·36		....
	38	14 Can. Ven...		"	13 01 33·52		33·92	......	......		13 01 33·67
	39	B.J. 491.......		"	05 56·84		57·28	57·06	−·22		05 57·03
	40	B.J. 492.......		"	07 41·91		42·21	41·93	−·28		07 41·96
	41	19 Can. Ven...		"	11 30·85		31·32	......	......		11 31·07
	42	B.J. 494.......		"	13 32·02		32·48	32·31	−·17		13 32·23
	43	23 Can. Ven...		"	16 18·65		19·11	......	......		16 18·86
	44	B.J. 497.......		"	20 20·05		20·83	20·67	......		20 20·58
	45	α Urs. Min....	L.C.	"	26 14·53		50·92	51·09	·17		....
	46	B.J. 502.......		"	30 48·39		48·81	48·52	−·29		30 48·56
	47	25 Can. Ven...		"	33 29·40		29·81	......	......		33 29·56
	48	B.J. 507.......		"	43 00·66		00·84	00·56	−·28		43 00·59
	49	B.J. 509.......		"	44 01·53		02·16	01·97	......		44 01·91

From May 15 Clamp West; from May 16 Clamp East.
1−18. Adopted $\Delta T+m=-\cdot276+\cdot0031\ (T-13^h\ 40^m)$.
19−49. Adopted $\Delta T+m=-\cdot253+\cdot0031\ (T-13^h\ 10^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 16	1	B.J. 513.......		N	13 50 25·53	·016	25·72	25·44	−·28	−·25	13 50 25·47
	2	B.J. 517.......		"	57 07·30	(·517)	07·59	07·29	−·30		57 07·34
	3	9 H.Boötis....		"	14 04 21·70		22·23	.....	....		14 04 21·98
	4	B.J. 522.......		"	06 19·32		19·58	19·30	−·28		06 19·33
	5	B.J. 526.......		"	11 34·95		35·15	34·87	−·28		11 34·90
	6	B.J. 527.......		"	12 59·59		00·15	59·95	....		12 59·90
	7	*f* Boötis......		"	22 17·81		18·01	.....	....		22 17·76
	8	204 B.Boötis..		"	26 05·73		06·22	.....	....		26 05·97
	9	B.J. 534.......		"	27 58·68		59·01	58·84	−·17		27 58·76
	10	σ Boötis......		"	30 47·44		47·76	.....	....		30 47·51
	11	B.J. 540.......		"	35 31·13		31·66	31·42	−·24		35 31·41
	12	B.J. 543.......		"	36 52·69		52·83	52·57	−·26		36 52·58
	13	34 Boötis.....		"	39 29·70		29·98	.....	....		39 29·73
	14.	ε Boötis......		"	41 05·10		05·39	.....	....		41 05·14
	15	295 B.Boötis..		"	45 36·52		36·95	.....	....		45 36·70
	16	ξ Boötis......		"	47 15·76		15·95	.....	....		47 15·70
	17	B.J. 549.......		"	49 11·44		12·35	12·25	....		49 12·10
May 17	18	B.J. 456.......		S	12 11 00·05	−·003	00·78	00·70	....	−·15	12 11 00·63
	19	B.J. 461.......		"	21 26·18	(·498)	26·62	26·54	−·08		21 26·47
	20	B.J. 467.......		"	25 47·02		47·79	47·63	....		25 47·64
	21	B.J. 470.......		"	29 29·48		29·96	29·84	−·12		29 29·81
	22	9 Can. Ven....		"	34 27·82		28·29	.....	....		34 28·14
	23	32^2 H. Camel.		"	48 34·84		39·12	38·84	−·28		....
	24	B.J. 485.......		"	51 50·53		50·96	50·79	−·17		51 50·81
	25	43 H. Cephei..	L.C.	"	56 06·27		59·92	59·67	−·25		....
	26	14 Can. Ven...		"	13 01 33·42		33·81	.....	....		13 01 33·66
	27	B.J. 494.......		"	13 32·01		32·47	32·30	−·17		13 32·32
	28	23 Can. Ven...		"	16 18·51		18·97	.....	....		16 18·82
	29	B.J. 497.......		"	20 20·12		20·79	20·65	....		20 20·64
	30	α Urs. Min....	L.C.	"	26 15·17		52·29	51·64	−·65		....
	31	81 Urs. Maj...		"	30 41·65		42·33	.....	....		30 42·18
	32	25 Can. Ven...		"	33 29·29		29·69	.....	....		33 29·54
	33	B.J. 509.......		"	44 01·55		02·10	01·96	....		44 01·95
	34	B.J. 527.......		"	14 12 59·61		00·10	59·95	....		14 12 59·95
	35	B.J. 531.......		"	22 09·94		10·54	10·45	....	−·14	22 10·40
	36	*g* Boötis......		"	25 31·89		32·45	.....	....		25 32·31
	37	B.J. 535.......		"	28 28·88		29·31	29·20	−·11		28 29·17
	38	σ Boötis......		"	30 47·28		47·59	.....	....		30 47·45
May 19	39	31 Comae.....		S	12 47 19·89	·004	20·20	.....	....	·09	12 47 20·29
	40	B.J. 483.......		"	50 05·73	(·522)	06·48	06·66	....		50 06·57
	41	B.J. 485.......		"	51 50·26		50·72	50·78	·06		51 50·81
	42	43 H. Cephei..	L.C.	"	56 06·50		59·71	00·10	·39		....
	43	14 Can. Ven...		"	13 01 33·12		33·53	.....	....		13 01 33·62
	44	15 Can. Ven...		"	05 34·73		35·19	.....	....		05 35·28
	45	B.J. 491.......		"	05 56·44		56·90	57·04	·14		05 56·99
	46	B.J. 492.......		"	07 41·47		41·78	41·91	·13		07 41·87
	47	19 Can. Ven...		"	11 30·42		30·92	.....	....		11 31·01
	48	B.J. 494.......		"	13 31·67		32·16	32·29	·13		13 32·25

Clamp East. 1−17. Adopted $\Delta T+m=-\cdot253+\cdot0031\ (T-13^h\ 10^m)$.
18−38. Adopted $\Delta T+m=-\cdot148+\cdot0032\ (T-13^h\ 25^m)$.
39−48. Adopted $\Delta T+m=\cdot099+\cdot0032\ (T-14^h\ 45^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation.
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 19	1	23 Can. Ven...		S	13 16 18·23	·004	18·72	.....	....	·09	13 16 18·81
	2	B.J. 497.......		"	20 19·77	(·522)	20·49	20·63	....		20 20·58
	3	α Urs. Min....	L.C.	"	26 15·91		51·49	52·92	1·43		....
	4	B.J. 502.......		"	30 48·04		48·48	48·50	·02	·10	30 48·58
	5	25 Can. Ven...		"	33 28·99		29·42	.....	....		33 29·52
	6	B.J. 507.......		"	43 00·28		00·47	00·56	·09		43 00·57
	7	B.J. 509.......		"	44 01·13		01·72	01·95	....		44 01·82
	8	B.J. 513.......		"	50 25·17		25·37	25·44	·07		50 25·47
	9	B.J. 517.......		"	57 06·85		07·16	07·29	·13		57 07·26
	10	9 H. Boötis...		"	14 04 21·39		21·94	.....	....		14 04 22·04
	11	B.J. 522.......		"	06 18·92		19·20	19·30	·10		06 19·30
	12	B.J. 526.......		"	11 34·65		34·86	34·87	·01		11 34·96
	13	B.J. 527.......		"	12 59·24		59·76	59·94	....		12 59·86
	14	f Boötis.		"	22 17·45		17·66	.....	....		22 17·76
	15	204 B. Boötis..		"	26 05·41		05·93	.....	....		26 06·03
	16	B.J. 534.......		"	27 58·38		58·72	58·84	·12		27 58·82
	17	σ Boötis......		"	30 47·03		47·36	.....	....		30 47·46
	18	B.J. 540.......		"	35 30·65		31·21	31·42	·21		35 31·31
	19	B.J. 543.......		"	36 52·34		52·49	52·58	·09		36 52·59
	20	34 Boötis.....		"	39 29·37		29·67	.....	....		39 29·77
	21	ε Boötis.......		"	41 04·75		05·05	.....	....		41 05·15
	22	295 B. Boötis..		"	45 36·11		36·56	.....	....		45 36·66
	23	ξ Boötis.......		"	47 15·42		15·62	.....	....		47 15·72
	24	B.J. 551.......		"	51 59·63		59·79	59·89	·10		51 59·89
	25	B.J. 555.......		"	58 34·77		35·26	35·39	·13		58 35·36
	26	B.J. 557.......		"	15 00 36·68		36·98	37·08	·10		15 00 37·08
	27	c Boötis.......		"	03 22·23		22·51	.....	....		03 22·61
	28	Groom. 2283..		"	06 20·52		31·87	32·96	1·09		....
	29	B.J. 578.......		"	30 54·15		54·45	54·37	− ·08		30 54·55
	30	B.J. 580.......		"	34 37·05		37·54	37·71	·17		34 37·64
	31	ζ Cor. Bor....		"	36 00·65		01·08	.....	....		36 01·18
	32	ι Serpentis.....		"	37 33·63		33·84	.....	....		37 33·94
	33	B.J. 581.......		"	38 59·10		59·39	59·53	·14		38 59·49
	34	B.J. 583.......		"	42 03·36		03·53	03·62	·09		42 03·63
	35	B.J. 584.......		"	44 42·65		42·84	42·93	·09		44 42·94
	36	χ Herculis....		"	49 35·29		35·81	.....	....		49 35·91
	37	B.J. 591.......		"	52 19·00		19·17	19·35	·18		52 19·27
	38	B.J. 593.......		"	53 52·98		53·28	53·40	·12		53 53·38
	39	B.J. 595.......		"	55 40·98		41·70	41·84	....		55 41·80
	40	r Herculis.....		"	57 12·96		13·15	.....	....		57 13·25
	41	B.J. 598.......		"	16 00 13·93		14·75	14·97	....		16 00 14·85
	42	κ Herculis.....		"	04 02·10		02·28	.....	....		04 02·38
	43	τ Cor. Bor....		"	05 42·22		42·65	.....	....		05 42·75
	44	σ^2 Cor. Bor..		"	11 19·91		20·30	.....	....		11 20·40
	45	B.J. 609.......		"	17 58·27		58·47	58·59	·12		17 58·57
	46	23 Herculis....		"	19 30·47		30·83	.....	....		19 30·93
	47	B.J. 613.......		"	21 17·04		17·19	17·30	·11		21 17·29
	48	g Herculis.....		"	25 42·47		42·98	.....	....		25 43·08
	49	B.J. 621.......		"	31 13·48		14·00	14·11	·11		31 14·10
	50	ζ Herculis.....		"	37 54·96		55·31	.....	....	·11	37 55·42

Clamp East. Adopted $\Delta T+m = \cdot 099 + \cdot 0032$ (T−14ʰ 45ᵐ).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 19	1	B.J. 626.......		S	16 39 49·89	·004	50·35	50·54	·19	·11	16 39 50·46
	2	B.J. 627.......		"	43 36·88	(·522)	37·64	37·96	....		43 37·75
May 21	3	1 Can. Ven....		N	12 10 16·80	·015	17·48	.....	....	·25	12 10 17·73
	4	B.J. 458.......		"	11 37·82	(·482)	38·26	38·57	·31		11 38·51
	5	Bradley 1672..		"	14 41·58		56·95	58·07	1·12		....
	6	B.J. 461.......		"	21 25·79		26·21	26·49	·28		21 26·46
	7	15 Comae.....		"	22 27·97		28·26	.....	....		22 28·51
	8	B.J. 467.......		"	25 46·47		47·29	47·54	....		25 47·54
	9	B.J. 470.......		"	29 29·05		29·50	29·79	·29		29 29·75
	10	23 Comae.....		"	30 22·83		23·05	.....	....		30 23·30
	11	9 Can. Ven....		"	34 27·44		27·88	.....	....		34 28·13
	12	32² H. Camel.		"	48 33·25		37·78	38·28	·50		....
	13	B.J. 483.......		"	50 05·59		06·34	06·62	....		50 06·59
	14	B.J. 485.......		"	51 50·09		50·50	50·76	·26		51 50·75
	15	43 H. Cephei..	L.C.	"	56 05·87		59·79	00·59	·80		....
	16	14 Can. Ven...		"	13 01 32·98		33·35	.....	....		13 01 33·60
	17	15 Can. Ven...		"	05 34·58		34·99	.....	....		05 35·24
	18	B.J. 491.......		"	05 56·36		56·77	57·02	·25		05 57·02
	19	B.J. 492.......		"	07 41·34		41·61	41·90	·29		07 41·86
	20	19 Can. Ven...		"	11 30·28		30·72	.....	....		11 30·97
	21	B.J. 494.......		"	13 31·56		31·99	32·27	·28		13 32·24
	22	23 Can. Ven...		"	16 18·15		18·58	.....	....		16 18·83
	23	B.J. 497.......		"	20 19·56		20·28	20·60	....		20 20·53
	24	α Urs. Min....	L.C.	"	26 15·06		53·20	54·46	1·26		....
	25	B.J. 502.......		"	30 47·88		48·27	48·49	·22		30 48·52
	26	25 Can. Ven...		"	33 28·88		29·26	.....	....		33 29·51
	27	B.J. 507.......		"	43 00·11		00·27	00·55	·28		43 00·52
	28	B.J. 509.......		"	44 01·05		01·64	01·93	....	·26	44 01·90
	29	B.J. 513.......		"	50 25·01		25·18	25·44	·26		50 25·44
	30	B.J. 517.......		"	57 06·69		06·96	07·28	·32		57 07·22
	31	9 H. Boötis...		"	14 04 21·20		21·69	.....	....		14 04 21·95
	32	B.J. 522.......		"	06 18·80		19·04	19·30	·26		06 19·30
	33	B.J. 526.......		"	11 34·46		34·64	34·87	·23		11 34·90
	34	B.J. 527.......		"	12 59·18		59·71	59·93	....		12 59·97
	35	f Boötis......		"	22 17·34		17·52	.....	....		22 17·78
	36	204 B. Boötis..		"	26 05·30		05·76	....	....		26 06·02
	37	B.J. 534.......		"	27 58·29		58·60	58·84	·24		27 58·86
	38	σ Boötis......		"	30 46·92		47·22	.....	....		30 47·48
	39	B.J. 540.......		"	35 30·67		31·17	31·41	·24		35 31·43
	40	B.J. 543.......		"	36 52·23		52·36	52·58	·22		36 52·62
	41	34 Boötis.....		"	39 29·24		29·50	.....	....		39 29·76
	42	ε Boötis......		"	41 04·65		04·91	.....	....		41 05·17
	43	295 B. Boötis..		"	45 36·03		36·43	.....	....		45 36·69
	44	ξ Boötis......		"	47 15·37		15·55	.....	....		47 15·81
	45	B.J. 549.......		"	49 11·07		11·91	12·23	....		49 12·17
May 26	46	B.J. 483.......		N	12 50 05·07	−·014	05·68	06·51	....	·81	12 50 06·49
	47	B.J. 485.......		"	51 49·56	(·414)	49·87	50·70	·83		51 50·68
	48	43 H. Cephei..	L.C.	"	56 05·82		00·58	01·92	1·34		....

From May 19 Clamp East; from May 26 Clamp West.
1,2. Adopted $\Delta T+m=\cdot 099+\cdot 0032\ (T-14^h\ 45^m)$.
3–45. Adopted $\Delta T+m=\cdot 254+\cdot 0032\ (T-13^h\ 25^m)$.
46–48. Adopted $\Delta T+m=\cdot 815+\cdot 0033\ (T-14^h\ 45^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 26	1	14 Can. Ven...		N	13 01 32·44	−·014	32·73	.....	....	·81	13 01 33·54
	2	15 Can. Ven...		"	05 34·03	(·414)	34·35	.....	....		05 35·16
	3	B.J. 491.......		"	05 55·80		56·12	56·96	·84		05 56·93
	4	B.J. 494.......		"	13 31·04		31·38	32·22	·84		13 32·19
	5	23 Can. Ven...		"	16 17·63		17·97	.....	....		16 18·78
	6	B.J. 507.......		"	42 59·58		59·71	00·53	·82		43 00·52
	7	B.J. 509.......		"	44 00·54		01·01	01·87	....		44 01·82
	8	B.J. 513.......		"	50 24·41		24·55	25·42	·87		50 25·36
	9	B.J. 517.......		"	57 06·27		06·48	07·27	·79		57 07·29
	10	9 H. Boötis...		"	14 04 20·73		21·12	.....	....		14 04 21·93
	11	B.J. 522.......		"	06 18·27		18·46	19·29	·83		06 19·27
	12	B.J. 526.......		"	11 33·82		33·97	34·86	·89		11 34·78
	13	B.J. 527.......		"	12 58·57		58·99	59·89	....		12 59·80
	14	204 B. Boötis.		"	26 04·80		05·16	.....	....		26 05·97
	15	B.J. 534		"	27 57·74		57·98	58·83	·85		27 58·79
	16	B.J. 535.......		"	28 28·09		28·40	29·18	·78		28 29·21
	17	σ Boötis......		"	30 46·45		46·68	.....	....		30 47·49
	18	B.J. 540.......		"	35 30·12		30·51	31·39	·88		35 31·32
	19	B.J. 543.......		"	36 51·70		51·80	52·59	·79		36 52·61
	20	31 Boötis.....		"	39 28·75		28·95	.....	....		39 29·76
	21	ε Boötis.......		"	41 04·03		04·24	.....	....		41 05·05
	22	295 B. Boötis..		"	45 35.50		35·81	.....	....	·82	45 36·63
	23	ξ Boötis.......		"	47 14.82		14·97	.....	....		47 15·79
	24	B.J. 549.......		"	49 10.66		11·35	12·18	....		49 12·17
	25	B.J. 555.......		"	58 34.18		34·52	35·39	·87		58 35·34
	26	B.J. 583.......		"	15 42 02.72		02·84	03·67	·83		15 42 03·66
	27	B.J. 584.......		"	44 42.06		42·20	42·98	·78		44 43·02
	28	χ Herculis....		"	49 34.75		35·11	.....	....		49 35·93
	29	B.J. 591.......		"	52 18.54		18·66	19·41	·75		52 19·48
	30	B.J. 593.......		"	53 52 49		52·69	53·45	·76		53 53·51
	31	B.J. 595.......		"	55 40.41		40·98	41·86	....		55 41·80
	32	τ Herculis.....		"	57 12.37		12·51	.....	....		57 13·33
	33	B.J. 598.......		"	16 00 13.45		14·11	14·99	....		16 00 14·93
	34	B.J. 614.......		"	22 28.40		28·98	29·84	....		22 29·80
	35	B.J. 621.......		"	31 13.03		13·39	14·18	·79		31 14·21
	36	B.J. 626.......		"	39 49.42		49·74	50·61	·87		39 50·56
	37	B.J. 627.......		"	43 36.47		37·09	38·03	....		43 37·91
	38	53 Herculis....		"	49 34.08		34·33	.....	....		49 35·15
	39	ε Urs. Min....		"	55 15.12		18·13	19·19	1·06		....
May 27	40	σ Boötis......		S	14 30 46·39	−·011	46·65	.....	....	·83	14 30 47·48
	41	B.J. 540.......		"	35 30·11	(·422)	30·55	31·38	·83		35 31·38
	42	B.J. 543.......		"	36 51·65		51·79	52·59	·80		36 52·62
	43	34 Boötis.....		"	39 28·67		28·91	.....	....		39 29·74
	44	ε Boötis.......		"	41 04·06		04·30	.....	....		41 05·13
	45	295 B. Boötis..		"	45 35·46		35·81	.....	....		45 36·64
	46	ξ Boötis..... ..		"	47 14·71		14·88	.....	....		47 15·71
	47	B.J. 549.......		"	49 10·64		11·30	12·17	....		49 12·13
	48	B.J. 551.......		"	51 58·92		59·06	59·90	·84		51 59·89
	49	B.J. 555.......		"	58 34·14		34·52	35·39	·87		58 35·35

Clamp West. 1–39. Adopted $\Delta T+m = \cdot 815 + \cdot 0033$ (T-14^{h} 45^{m}).
40–49. Adopted $\Delta T+m = \cdot 836 + \cdot 0033$ (T-15^{h} 55^{m}).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 27	1	*i* Boötis.......		S	15 00 50·46	−·011	50·88	......	......	·83	15 00 51·71
	2	*c* Boötis.......		"	03 21·55	(·422)	21·77	......	......		03 22·60
	3	Groom. 2283..		"	06 20·24		29·79	31·19	1·40		....
	4	B.J. 563.......		"	11 53·18		53·48	54·34	·86		11 54·31
	5	η Cor. Bor....		"	19 29·91		30·18	......	......		19 31·01
	6	B.J. 568.......		"	21 06·18		06·52	07·39	·87		21 07·35
	7	B.J. 571.......		"	22 56·91		57·56	58·53	......		22 58·39
	8	B.J. 572.......		"	24 07·84		08·10	08·91	·81		24 08·93
	9	B.J. 573.......		"	27 42·60		42·99	43·86	·87		27 43·82
	10	ν^2 Boötis		"	28 34·42		34·81	......	......		28 35·64
	11	B.J. 576.......		"	29 18·72		19·00	19·88	·88		29 19·83
	12	B.J. 578.......		"	30 53·40		53·64	54·42	·78		30 54·47
	13	B.J. 580.......		"	34 36·52		36·90	37·74	·84		34 37·73
	14	ζ Cor. Bor....		"	36 00·10		00·44	......	......		36 01·27
	15	ι Serpentis....		"	37 32·92		33·09	......	......	·84	37 33·93
	16	B.J. 581.......		"	38 58·38		58·61	59·58	·97		38 59·45
	17	B.J. 583.......		"	42 02·63		02·77	03·68	·91		42 03·61
	18	B.J. 584.......		"	44 42·03		42·19	42·99	·80		44 43·03
	19	χ Herculis....		"	49 34·75		35·16	......	......		49 36·00
	20	B.J. 591.......		"	52 18·43		18·57	19·42	·85		52 19·41
	21	B.J. 593.......		"	53 52·46		52·70	53·46	·76		53 53·54
	22	B.J. 595.......		"	55 40·47		41·01	41·86	......		55 41·85
	23	τ Herculis.....		"	57 12·32		12·48	......	......		57 13·32
	24	B.J. 598.......		"	16 00 13·49		14·13	14·99	......		16 00 14·97
	25	κ Herculis....		"	04 01·48		01·64	......	......		04 02·48
	26	B.J. 601.......		"	05 57·10		57·48	58·22	......		05 58·32
	27	Groom. 750...	L.C.	"	07 46·66		41·52	43·34	1·82		....
	28	B.J. 621.......		"	31 12·87		13·28	14·19	·91		31 14·12
	29	42 Herculis...		"	36 19·25		19·69	......	......		36 20·53
	30	ζ Herculis.....		"	37 54·35		54·63	......	......		37 55·47
	31	B.J. 626.......		"	39 49·43		49·79	50·62	·83		39 50·63
	32	B.J. 627.......		"	43 36·53		37·12	38·04	......		43 37·96
	33	B.J. 629.......		"	47 59·62		59·76	00·64	·88		48 00·60
	34	53 Herculis....		"	49 34·01		34·29	......	......		49 35·13
	35	ε Urs. Min....		"	55 15·12		18·04	19·18	1·14		....
	36	*d* Herculis....		"	58 17·61		17·91	......	......		58 18·75
	37	B.J. 635.......		"	17 01 12·95		13·08	13·90	·82		17 01 13·92
	38	B.J. 636.......		"	04 51·29		51·67	52·56	·89		04 52·51
	39	B.J. 640.......		"	10 33·34		33·48	34·24	·76		10 34·32
	40	B.J. 643.......		"	11 55·46		55·80	56·62	·82		11 56·64
	41	*e* Herculis.....		"	14 34·73		35·07	......	......		14 35·91
	42	*w* Herculis....		"	17 18·13		18·42	......	......		17 19·26
	43	ρ Herculis.....		"	20 35·34		35·68	......	......		20 36·52
	44	B.J. 650.......		"	24 22·03		22·45	23·26	......		24 23·29
	45	λ Herculis		"	27 06·68		06·91	......	......		27 07·75
	46	B.J. 653.......		"	28 24·80		25·30	26·23	......		28 26·14
	47	Groom. 944...	L.C.	"	32 51·79		46·82	47·60	·78		....
	48	B.J. 663.......		"	36 56·11		56·50	57·47	......		36 57·34

Clamp West. Adopted $\Delta T+m = \cdot 836 + \cdot 0033$ (T$-15^h\ 55^m$).

26. Observed facing north.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 28	1	Bradley 1672..		N	12 14 38·30	– ·002	52·58	53·75	1·17	·90	....
	2	B.J. 461.......		"	21 25·14	(·432)	25·49	26·40	·91		12 21 26·39
	3	15 Comae.....		"	22 27·32		27·56	.....	....		22 28·46
	4	B.J. 467.......		"	25 45·72		46·44	47·36	....		25 47·34
	5	B.J. 470.......		"	29 28·38		28·77	29·69	·92		29 29·67
	6	23 Comae.....		"	30 22·15		22·35	.....	....		30 23·25
	7	9 Can. Ven....		"	34 26·73		27·11	.....	....		34 28·01
	8	32^2 H. Camel..		"	48 31·95		36·11	37·19	1·08		....
	9	B.J. 485.......		"	51 49·49		49·84	50·68	·84		51 50·74
	10	43 H. Cephei..	L.C.	"	56 06·36		00·72	02·37	1·65		....
	11	14 Can. Ven...		"	13 01 32·29		32·61	.....	....		13 01 33·51
	12	15 Can. Ven...		"	05 33·88		34·23	.....	....		05 35·13
	13	B.J. 491.......		"	05 55·69		56·04	56·94	·90		05 56·94
	14	B.J. 492.......		"	07 40·70		40·93	41·85	·92		07 41·83
	15	19 Can. Ven...		"	11 29·63		30·01	.....	....		11 30·91
	16	B.J. 494.......		"	13 30·87		31·24	32·20	·96		13 32·14
	17	B.J. 497.......		"	20 18·88		19·51	20·48	....		20 20·41
	18	α Urs. Min....	L.C.	"	26 17·11		56·87	00·21	3·34		....
	19	B.J. 502.......		"	30 47·18		47·51	48·43	·92		30 48·41
	20	25 Can. Ven...		"	33 28·24		28·56	.....	....		33 29·46
	21	B.J. 507.......		"	42 59·45		59·60	00·53	·93		43 00·50
	22	B.J. 509.......		"	44 00·37		00·88	01·85	....		44 01·78
	23	9 H. Boötis...		"	14 04 20·60		21·02	.....	....		14 04 21·92
	24	B.J. 522.......		"	06 18·15		18·37	19·28	·91		06 19·27
	25	B.J. 526.......		"	11 33·83		34·00	34·85	·85		11 34·90
	26	B.J. 527.......		"	12 58·50		58·95	59·87	....		12 59·85
	27	B.J. 531.......		"	22 08·79		09·35	10·37	....		22 10·25
	28	204 B. Boötis..		"	26 04·67		05·06	.....	....		26 05·96
	29	B.J. 534.......		"	27 57·65		57·91	58·82	·91		27 58·81
	30	B.J. 535.......		"	28 27·89		28·24	29·17	·93	·91	28 29·15
	31	σ Boötis.......		"	30 46·30		46·55	.....	....		30 47·46
	32	B.J. 540.......		"	35 30·03		30·46	31·38	·92		35 31·37
	33	B.J. 543.......		"	36 51·60		51·72	52·59	·87		36 52·63
	34	34 Boötis.....		"	39 28·69		28·92	.....	....		39 29·83
	35	ε Boötis.......		"	41 04·00		04·24	.....	....		41 05·15
	36	295 B. Boötis..		"	45 35·41		35·75	.....	....		45 36·66
	37	ξ Boötis.......		"	47 14·69		14·85	.....	....		47 15·76
	38	B.J. 549.......		"	49 10·51		11·25	12·16	....		49 12·16
	39	B.J. 551.......		"	51 58·86		58·98	59·91	·93		51 59·89
	40	B.J. 555.......		"	58 34·05		34·42	35·39	·97		58 35·33
	41	B.J. 557.......		"	15 00 35·99		36·23	37·09	·86		15 00 37·14
	42	Groom. 2283..		"	06 17·87		28·42	30·97	2·55		....
	43	B.J. 563.......		"	11 53·12		53·41	54·35	·94		11 54·32
	44	η Cor. Bor.....		"	19 29·80		30·05	.....	....		19 30·96
	45	B.J. 568.......		"	21 06·17		06·51	07·40	·89		21 07·42
	46	B.J. 571.......		"	22 56·74		57·47	58·53	....		22 58·38
	47	B.J. 573.......		"	27 42·58		42·96	43·87	·91		27 43·87
	48	ν^2 Boötis......		"	28 34·49		34·87	.....	....		28 35·78
	49	B.J. 576.......		"	29 18·73		19·00	19·88	·88		29 19·91
	50	B.J. 578.......		"	30 53·27		53·50	54·42	·92		30 54·41

Clamp West.

Adopted $\Delta T+m=\cdot 904+\cdot 0033\ (T-14^h\ 10^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
May 28	1	B.J. 580.......		N	15 34 36·42	−·002	36·79	37·74	·95	·91	15 34 37·70
	2	ζ Cor. Bor....		"	36 00·05	(·432)	00·37	.....	....		36 01·28
	3	ι Serpentis....		"	37 32·95		33·12	.....	....		37 34·03
	4	B.J. 581.......		"	38 58·42		58·65	59·59	·94		38 59·56
	5	B.J. 583.......		"	42 02·59		02·72	03·69	·97		42 03·63
	6	B.J. 584.......		"	44 41·93		42·08	43·00	·92		48 42·99
	7	χ Herculis.....		"	49 34·69		35·09	.....	....		49 36·00
	8	B.J. 591.......		"	52 18·34		18·48	19·43	·95		52 19·39
	9	B.J. 593.......		"	53 52·38		52·61	53·47	·86		53 53·52
	10	B.J. 595.......		"	55 40·37		40·99	41·87	....		55 41·90
	11	r Herculis.....		"	57 12·31		12·46	.....	....		57 13·37
June 3	12	32² H. Camel..		S	12 48 31·01	−·025	34·97	36·19	1·22	1·40	....
	13	B.J. 485.......		"	51 48·85	(·456)	49·22	50·60	1·38		12 51 50·62
	14	43 H. Cephei..	L.C.	"	56 07·94		01·97	03·87	1·90		....
	15	14 Can. Ven...		"	13 01 31·77		32·10	.....	....		13 01 33·50
	16	15 Can. Ven...		"	05 33·28		33·65	.....	....		05 35·05
	17	B.J. 491.......		"	05 55·10		55·47	56·87	1·40		05 56·87
	18	B.J. 492.......		"	07 40·13		40·38	41·80	1·42		07 41·78
	19	19 Can. Ven...		"	11 29·02		29·42	.....	....		11 30·82
	20	B.J. 494.......		"	13 30·30		30·69	32·13	1·44		13 32·09
	21	23 Can. Ven...		"	16 16·84		17·23	.....	....		16 18·63
	22	B.J. 497.......		"	20 18·29		18·87	20·36	....		20 20·27
	23	α Urs. Min....	L.C.	"	26 26·07		04·65	04·99	·34		....
	24	B.J. 502.......		"	30 46·62		46·97	48·37	1·40		30 48·37
	25	25 Can. Ven...		"	33 27·61		27·95	.....	....	1·41	33 29·36
	26	B.J. 507.......		"	42 58·94		59·10	00·49	1·39		43 00·51
	27	B.J. 509.......		"	43 59·82		00·29	01·76	....		44 01·70
	28	B.J. 513.......		"	50 23·79		23·96	25·38	1·42		50 25·37
	29	B.J. 517.......		"	57 05·50		05·74	07·22	1·48		57 07·15
	30	9 H. Boötis...		"	14 04 19·99		20·44	.....	....		14 04 21·85
	31	B.J. 522.......		"	06 17·57		17·80	19·25	1·45		06 19·21
	32	B.J. 526.......		"	11 33·29		33·46	34·83	1·37		11 34·87
	33	B.J. 527.......		"	12 57·94		58·35	59·81	....		12 59·76
	34	B.J. 531.......		"	22 08·32		08·83	10·29	....		22 10·24
	35	204 B. Boötis..		"	26 04·10		04·52	.....	....		26 05·93
	36	B.J. 534.......		"	27 57·08		57·35	58·80	1·45		27 58·76
	37	σ Boötis.......		"	30 45·77		46·03	.....	....		30 47·44
	38	B.J. 540.......		"	35 29·49		29·94	31·34	1·40		35 31·35
	39	B.J. 543.......		"	36 51·06		51·18	52·59	1·41		36 52·59
	40	34 Boötis.....		"	39 28·03		28·27	.....	....		39 29·68
	41	ε Boötis.......		"	41 03·46		03·71	.....	....		41 05·12
	42	295 B. Boötis..		"	45 34·86		35·22	.....	....		45 36·63
	43	ξ Boötis.......		"	47 14·18		14·35	.....	....		47 15·76
	44	B.J. 549.......		"	49 09·96		10·65	12·08	....		49 12·06
	45	B.J. 551.......		"	51 58·38		58·51	59·91	1·40		51 59·92
	46	B.J. 555.......		"	58 33·53		33·92	35·37	1·45		58 35·33
	47	B.J. 557.......		"	15 00 35·43		35·68	37·09	1·41		15 00 37·09
	48	c Boötis......		"	03 20·96		21·18	.....	....		03 22·59
	49	Groom. 2283..		"	06 16·72		26·76	29·71	2·95		....

Clamp West. 1−11. Adopted $\Delta T+m = \cdot 904 + \cdot 0033\ (T - 14^h\ 10^m)$.
12−49. Adopted $\Delta T+m = 1\cdot 408 + \cdot 0034\ (T - 14^h\ 25^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m^{\circ}$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 3	1	B.J. 563.......		S	15 11 52·61	−·025	52·92	54·34	1·42	1·41	15 11 54·33
	2	η Cor. Bor....		"	19 29·34	(·456)	29·61	.....	....		19 31·02
	3	B.J. 568.......		"	21 05·68		06·03	07·39	1·36		21 07·44
	4	B.J. 571.......		"	22 56·31		56·99	58·47	....		22 58·40
	5	B.J. 572.......		"	24 07·22		07·48	08·92	1·44		24 08·89
	6	B.J. 573.......		"	27 42·06		42·46	43·86	1·40		27 43·87
	7	ν^2 Boötis......		"	28 33·92		34·32	.....	....		28 35·73
	8	B.J. 576.......		"	29 18·16		18·44	19·89	1·45		29 19·85
	9	B.J. 578.......		"	30 52·83		53·07	54·43	1·36		30 54·48
	10	B.J. 580.......		"	34 35·88		36·27	37·75	1·48		34 37·68
	11	ζ Cor. Bor....		"	35 59·51		59·85	.....	....		36 01·26
	12	ι Serpentis....		"	37 32·42		32·59	.....	....		37 34·00
	13	B.J. 581.......		"	38 57·96		58·20	59·60	1·40		38 59·61
	14	B.J. 583.......		"	42 02·17		02·31	03·72	1·41		42 03·72
	15	B.J. 584.......		"	44 41·43		41·59	43·03	1·44		44 43·00
	16	χ Herculis....		"	49 34·08		34·50	.....	....		49 35·91
	17	B.J. 591.......		"	52 17·87		18·01	19·46	1·45		52 19·42
	18	B.J. 593.......		"	53 51·88		52·12	53·49	1·37		53 53·53
	19	B.J. 595.......		"	55 39·83		40·40	41·86	....		55 41·81
	20	r Herculis.....		"	57 11·84		12·00	.....	....		57 13·41
	21	B.J. 598.......		"	16 00 12·80		13·46	14·98	....		16 00 14·87
	22	κ Herculis.....		"	04 00·94		01·09	.....	....		04 02·50
	23	τ Cor. Bor....		"	05 41·03		41·37	.....	....		05 42·78
	24	Groom. 750...	L.C.	"	07 47·38		41·99	43·84	1·85		....
June 4	25	23 Can. Ven...		S	13 16 16·71	−·017	17·13	.....	....	1·45	13·16 18·58
	26	B.J. 497.......		"	20 18·19	(·480)	18·82	20·34	....		20 20·27
	27	α Urs. Min....	L.C.	"	26 25·06		02·08	05·99	3·91		....
	28	B.J. 502.......		"	30 46·54		46·92	48·36	1·44		30 48·37
	29	25 Can. Ven...		"	33 27·56		27·93	.....	....		33 29·38
	30	B.J. 507.......		"	42 58·90		59·07	00·49	1·42		43 00·52
	31	B.J. 509.......		"	43 59·71		00·22	01·75	....		44 01·67
	32	B.J. 513.......		"	50 23·76		23·94	25·38	1·44		50 25·39
	33	B.J. 517.......		"	57 05·50		05·77	07·21	1·44		57 07·22
	34	9 H. Boötis...		"	14 04 19·84		20·32	.....	....		14 04 21·77
	35	B.J. 522.......		"	06 17·51		17·75	19·25	1·50		06 19·20
	36	B.J. 526.......		"	11 33·28		33·47	34·83	1·36		11 34·92
	37	B.J. 527.......		"	12 57·88		58·32	59·80	....		12 59·77
	38	B.J. 531.......		"	22 08·20		08·76	10·28	....		22 10·21
	39	204 B. Boötis..		"	26 04·04		04·49	.....	....		26 05·94
	40	B.J. 534.......		"	27 57·07		57·37	58·80	1·43		27 58·82
	41	σ Boötis......		"	30 45·69		45·98	.....	....		30 47·43
	42	B.J. 540.......		"	35 29·36		29·85	31·33	1·48		35 31·30
	43	B.J. 543.......		"	36 51·04		51·18	52·58	1·40		36 52·63
	44	34 Boötis.....		"	39 28·07		28·33	.....	....		39 29·78
	45	ϵ Boötis......		"	41 03·40		03·66	.....	....		41 05·11
	46	295 B. Boötis..		"	45 34·70		35·09	.....	....		45 36·54
	47	ξ Boötis......		"	47 14·05		14·24	.....	....		47 15·69
	48	B.J. 549.......		"	49 09·86		10·61	12·06	....		49 12·06
	49	B.J. 555.......		"	58 33·49		33·91	35·36	1·45		58 35·36

Clamp West. 1–24. Adopted $\Delta T+m=1{\cdot}408+{\cdot}0034$ ($T-14^h\ 25^m$).
25–49. Adopted $\Delta T+m=1{\cdot}454+{\cdot}0035$ ($T-15^h\ 20^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 4	1	B.J. 557.......		S	15 00 35·43	— ·017	35·69	37·08	1·39	1·45	15 00 37·14
	2	c Boötis......		"	03 20·99	(·480)	21·24	....	....		03·22·69
	3	Groom. 2283..		"	06 16·18		26·98	29·38	2·40		....
	4	B.J. 563.......		"	11 52·66		52·99	54·34	1·35		11 54·44
	5	η Cor. Bor....		"	19 29·21		29·50	....	....		19 30·95
	6	B.J. 568.......		"	21 05·41		05·79	07·39	1·60		21 07·24
	7	B.J. 571.......		"	22 56·27		57·01	58·46	....		22 58·46
	8	B.J. 572.......		"	24 07·21		07·49	08·92	1·43		24 08·94
	9	B.J. 573.......		"	27 41·94		42·37	43·86	1·49		27 43·82
	10	ν² Boötis......		"	28 33·81		34·24	....	....		28 35·69
	11	B.J. 578.......		"	30 52·69		52·95	54·44	1·49		30 54·40
	12	B.J. 580.......		"	34 35·85		36·27	37·74	1·47		34 37·72
	13	ζ Cor. Bor....		"	36 59·47		59·84	....	....		37 01·29
	14	ι Serpentis.....		"	37 32·41		32·60	....	....	1·46	37 34·06
	15	B.J. 581......		"	38 57·88		58·13	59·61	1·48		38 59·59
	16	B.J. 583.......		"	42 02·09		02·24	03·72	1·48		42 03·70
	17	B.J. 584.......		"	44 41·35		41·53	43·03	1·50		41 42·99
	18	χ Herculis....		"	49 33·99		34·44	....	....		49 35·90
	19	B.J. 591.......		"	52 17·73		17·89	19·46	1·57		52 19·35
	20	B.J. 593.......		"	53 51·75		52·01	53·50	1·49		53 53·47
	21	B.J. 595.......		"	55 39·84		40·46	41·85	....		55 41·92
	22	r Herculis.....		"	57 11·73		11·91	....	....		57 13·37
	23	B.J. 598.......		"	16 00 12·73		13·45	14·98	....		16 00 14·91
	24	κ Herculis.....		"	04 00·88		01·05	....	....		04 02·51
	25	τ Cor. Bor.....		"	05 40·98		41·35	....	....		05 42·81
	26	Groom. 750...	L.C.	"	07 47·97		42·19	43·96	1·77		....
	27	σ² Cor. Bor...		"	11 18·58		18·92	....	....		11 20·38
	28	B.J. 609.......		"	17 57·12		57·31	58·74	1·43		17 58·77
	29	23 Herculis...		"	19 29·28		29·60	....	....		19 31·06
	30	B.J. 613.......		"	21 15·78		15·92	17·45	1·53		21 17·38
	31	g Herculis		"	25 41·35		41·79	....	....		25 43·25
	32	ε Urs. Min....		"	55 14·22		17·52	19·18	1·66		....
	33	d Herculis		"	58 17·15		17·48	....	....		58 18·94
	34	B.J. 635......		"	17 01 12·42		12·55	14·00	1·45		17 01 14·01
	35	B.J. 636.......		"	04 50·71		51·13	52·65	1·52		04 52·59
	36	B.J. 640.......		"	10 32·78		32·92	34·34	1·42		10 34·38
	37	B.J. 643......		"	11 54·89		55·26	56·71	1·45		11 56·72
	38	u Herculis		"	14 00·21		00·53	....	....		14 01·99
	39	w Herculis....		"	17 17·58		17·90	....	....		17 19·36
	40	ρ Herculis.....		"	20 34·83		35·21	....	....		20 36·67
June 7	41	B.J. 643.......		S	17 11 54·62	— ·021	54·97	56·74	1·77	1·71	17 11 56·68
	42	w Herculis.....		"	17 17·36	(·457)	17·66	....	....		17 19·37
	43	ρ Herculis.....		"	20 34·53		34·89	....	....		20 36·60
	44	B.J. 653......		"	28 24·06		24·58	26·37	....		28 26·29
	45	B.J. 663......		"	36 55·53		55·95	57·63	....		36 57·66
	46	B.J. 667......		"	42 56·00		56·25	57·97	1·72		42 57·96
	47	87 Herculis....		"	45 10·03		10·26	....	....		45 11·97
	48	z Herculis		"	47 42·09		42·55	....	....		47 44·26
	49	168 H¹. Herc..		"	49 08·91		09·30	....	....		49 11·01

Clamp West. 1—40. Adopted $\Delta T+m=1\cdot454+\cdot0035$ ($T-15^h\ 20^m$).
41—49. Adopted $\Delta T+m=1\cdot713+\cdot0035$ ($T-18^h\ 10^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 7	1	B.J. 671.......		S	17 51 58·55	−·021	59·17	00·95	......	1·71	17 52 00·88
	2	B.J. 672.......		"	53 09·84	(·457)	10·20	11·91	1·71		53 11·91
	3	B.J. 676.......		"	54 31·03		31·54	33·29	......		54 33·25
	4	B.J. 684.......		"	18 12 50·67		51·09	52·79	1·70		18 12 52·80
	5	446 B. Herc...		"	18 23·31		23·52	.....	......		18 25·23
	6	B. J. 690......		"	19 51·59		51·78	53·49	1·71		19 53·49
	7	μ Lyrae		"	21 15·69		16·08	.....	......		21 17·79
	8	B.J. 694.......		"	22 35·91		36·58	38·34	......		22 38·29
	9	B.J. 699.......		"	33 53·26		53·64	55·34	1·70		33 55·35
	10	51 H. Cephei..	L.C.	"	58 27·17		18·08	20·29	2·21	1·72	....
	11	B.J. 716.......		"	19 01 16·14		16·27	17·99	1·72		19 01 17·99
	12	B.J. 719.......		"	04 05·03		05·37	07·11	1·74		04 07·09
	13	λ Urs. Min....		"	11 23·55		48·26	51·25	2·99		....
	14	159 B. Lyrae..		"	15 57·19		57·59	.....	......		15 59·31
	15	b Aquilae.....		"	20 40·42		40·54	.....	......		20 42·26
	16	21 B. Vulp....		"	21 41·86		42·08	.....	......		21 43·80
	17	4 Cygni.......		"	22 54·16		54·50	.....	......		22 56·22
	18	α Vulp........		"	24 57·22		57·44	.....	......		24 59·16
	19	B.J. 733.......		"	27 25·89		26·40	28·10	......		27 28·12
	20	ϵ Sagittae.....		"	33 12·55		12·69	.....	......		33 14·41
	21	14 Cygni......		"	36 30·18		30·61	.....	......		36 32·33
June 8	22	43 H. Cephei..	L.C.	N	12 56 08·34	−·012	02·47	05·37	2·90	1·81	....
	23	14 Can. Ven...		"	13 01 31·30	(·459)	31·63	.....	......		13 01 33·44
	24	15 Can. Ven...		"	05 32·91		33·27	.....	......		05 35·08
	25	B.J. 491.......		"	05 54·61		54·97	56·81	1·84		05 56·78
	26	B.J. 492.......		"	07 39·71		39·95	41·75	1·80		07 41·76
	27	19 Can. Ven...		"	11 28·58		28·97	.....	......		11 30·78
	28	B.J. 494.......		"	13 29·83		30·21	32·06	1·85		13 32·02
	29	23 Can. Ven...		"	16 16·41		16·79	.....	......		16 18·60
	30	B.J. 497.......		"	20 17·79		18·44	20·26	......		20 20·25
	31	α Urs. Min....	L.C.	"	26 28·97		07·90	10·07	2·17		....
	32	B.J. 502.......		"	30 46·22		46·56	48·32	1·76		30 48·37
	33	25 Can. Ven...		"	33 27·23		27·56	.....	......		33 29·37
	34	B.J. 507.......		"	42 58·48		58·63	00·46	1·83		43 00·44
	35	B.J. 509.......		"	43 59·38		59·90	01·68	......		44 01·71
	36	B.J. 513.......		"	50 23·38		23·54	25·35	1·81		50 25·35
	37	B.J. 517.......		"	57 05·10		05·33	07·19	1·86		57 07·14
	38	9 H. Boötis...		"	14 04 19·60		20·03	.....	......		14 04 21·84
	39	B.J. 522.......		"	06 17·16		17·37	19·22	1·85		06 19·18
	40	B.J. 526.......		"	11 32·87		33·04	34·81	1·77		11 34·85
	41	B.J. 527.......		"	12 57·45		57·91	59·76	......		12 59·72
	42	B.J. 531.......		"	22 07·82		08·39	10·23	......		22 10·20
	43	204 B. Boötis..		"	26 03·78		04·19	.....	......		26 06·00
	44	B.J. 534.......		"	27 56·71		56·98	58·77	1·79		27 58·79
	45	B.J. 535.......		"	28 26·96		27·32	29·10	1·78		28 29·13
	46	σ Boötis......		"	30 45·28		45·54	.....	......		30 47·35
	47	B.J. 540.......		"	35 29·11		29·55	31·30	1·75		35 31·36
	48	B.J. 543.......		"	36 50·63		50·74	52·58	1·84		36 52·55
	49	34 Boötis.....		"	39 27·74		27·96	.....	......		39 29·77

Clamp West. 1−21. Adopted $\Delta T+m=1·713+·0035\ (T-18^h\ 10^m)$.
22−49. Adopted $\Delta T+m=1·811+·0035\ (T-14^h\ 30^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 8	1	ϵ Boötis.......		N	14 41 03·06	—·012	03·29	.....	....	1·81	14 41 05·10
	2	295 B. Boötis..		"	45 34·46	(·459)	34·81	.....	....		45 36·62
	3	ξ Boötis.......		"	47 13·82		13·98	.....	....		47 15·79
	4	B.J. 549.......		"	49 09·44		10·21	12·00	....		49 12·02
	5	B.J. 551.......		"	51 57·98		58·10	59·91	1·81		51 59·91
	6	B.J. 555.......		"	58 33·07		33·46	35·34	1·88		58 35·27
	7	B.J. 557.......		"	15 00 35·04		35·27	37·08	1·81		15 00 37·08
	8	c Boötis.......		"	03 20·55		20·76	.....	....		03 22·57
	9	Groom. 2283..		"	06 12·81		23·77	27·88	4·11		....
	10	B.J. 563.......		"	11 52·15		52·45	54·33	1·88		11 54·26
	11	η Cor. Bor.....		"	19 28·92		29·18	.....	....		19 30·99
	12	B.J. 568.......		"	21 05·21		05·55	07·38	1·83		21 07·36
	13	B.J. 571.......		"	22 55·77		56·52	58·42	....		22 58·33
	14	B.J. 573.......		"	27 41·57		41·96	43·85	1·89		27 43·77
	15	ν² Boötis......		"	28 33·57		33·96	.....	....		28 35·77
	16	B.J. 578.......		"	30 52·35		52·57	54·42	1·85		30 54·38
	17	B.J. 580.......		"	34 35·53		35·92	37·74	1·82		34 37·73
	18	ζ Cor. Bor....		"	35 59·18		59·51	.....	....		36 01·32
	19	ι Serpentis....		"	37 32·06		32·23	.....	....		37 34·04
	20	B.J. 581.......		"	38 57·60		57·82	59·61	1·79	1·82	38 59·64
	21	B.J. 583.......		"	42 01·86		01·99	03·74	1·75		42 03·81
	22	B.J. 584.......		"	44 41·04		41·19	43·05	1·86		44 43·01
	23	χ Herculis....		"	49 33·75		34·16	.....	....		49 35·98
	24	B.J. 591.......		"	52 17·55		17·68	19·48	1·80		52 19·50
	25	B.J. 593.......		"	53 51·49		51·71	53·51	1·80		53 53·53
	26	B.J. 595.......		"	55 39·32		39·96	41·84	....		55 41·78
	27	r Herculis		"	57 11·51		11·66	.....	....		57 13·48
	28	B.J. 598.......		"	16 00 12·32		13·06	14·96	....		16 00 14·88
	29	κ Herculis.....		"	04 00·60		00·74	.....	....		04 02·56
	30	τ Cor. Bor....		"	05 40·64		40·97	.....	....		05 42·79
	31	Groom. 750...	L.C.	"	07 47·71		42·41	44·54	2·13		....
June 9	32	23 Can. Ven...		S	13 16 16·25	—·021	16·66	.....	....	1·94	13 16 18·60
	33	B.J. 497.......		"	20 17·65	(·462)	18·25	20·23	....		20 20·19
	34	α Urs. Min....	L.C.	"	26 30·57		08·65	11·01	2·36		....
	35	B.J. 502.......		"	30 46·03		46·40	48·31	1·91		30 48·34
	36	25 Can. Ven...		"	33 27·06		27·42	.....	....		33 29·36
	37	B.J. 507.......		"	42 58·36		58·52	00·46	1·94		43 00·46
	38	B.J. 509.......		"	43 59·12		59·60	01·67	....		44 01·54
	39	B.J. 513.......		"	50 23·28		23·45	25·35	1·90		50 25·39
	40	B.J. 517.......		"	57 04·98		05·24	07·18	1·94		57 07·18
	41	9 H. Boötis...		"	14 04 19·38		19·83	.....	....		14 04 21·77
	42	B.J. 522.......		"	06 17·04		17·27	19·22	1·95		06 19·21
	43	B.J. 526.......		"	11 32·77		32·95	34·81	1·86		11 34·89
	44	B.J. 527.......		"	12 57·37		57·80	59·75	....		12 59·74
	45	B.J. 531.......		"	22 07·67		08·20	10·22	....		22 10·14
	46	g Boötis		"	25 29·69		30·17	.....	....		25 32·11
	47	B.J. 534.......		"	27 56·51		56·80	58·77	1·97		27 58·74
	48	σ Boötis		"	30 45·15		45·43	.....	....		30 47·37
	49	B.J. 540.......		"	35 28·86		29·32	31·29	1·97		35 31·26

Clamp West. 1–31. Adopted $\Delta T+m=1\cdot811+\cdot0035\ (T-14^h\ 30^m)$.
32–49. Adopted $\Delta T+m=1\cdot942+\cdot0035\ (T-14^h\ 40^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 9	1	B.J. 543.......		S	14 36 50·45	—·021	50·59	52·58	1·99	1·94	14 36 52·53
	2	34 Boötis.....		"	39 27·51	(·462)	27·76	.....	....		39 29·70
	3	ε Boötis.......		"	41 02·87		03·12	.....	....		41 05·06
	4	295 B. Boötis..		"	45 34·31		34·69	.....	....		45 36·63
	5	ξ Boötis.......		"	47 13·60		13·77	.....	....		47 15·71
	6	B.J. 549.......		"	49 09·35		10·06	11·98	....		49 12·00
	7	B.J. 551.......		"	51 57·81		57·95	59·91	1·96		51 59·89
	8	B.J. 555.......		"	58 32·97		33·38	35·34	1·96		58 35·32
	9	*i* Boötis		"	15 00 49·28		49·73	.....	....		15 00 51·67
	10	*c* Boötis		"	03 20·39		20·62	.....	....		03 22·56
	11	Groom. 2283..		"	06 14·18		24·47	27·54	3·07		....
	12	B.J. 563.......		"	11 52·06		52·38	54·33	1·95		11 54·32
	13	η Cor. Bor....		"	19 28·80		29·08	.....	....		19 31·02
	14	B.J. 568.......		"	21 05·06		05·43	07·38	1·95		21 07·37
	15	B.J. 571.......		"	22 55·69		56·39	58·41	....		22 58·33
	16	B.J. 572.......		"	24 06·66		06·93	08·92	1·99		24 08·87
	17	B.J. 573.......		"	27 41·47		41·88	43·85	1·97		27 43·82
	18	ν^2 Boötis.....		"	28 33·34		33·76	.....	....		28 35·70
	19	B.J. 578.......		"	30 52·25		52·50	54·44	1·94		30 54·44
	20	B.J. 580.......		"	34 35·41		35·82	37·74	1·92	1·95	34 37·77
	21	ζ Cor. Bor....		"	35 59·00		59·36	.....	....		36 01·31
	22	ι Serpentis....		"	37 31·88		32·06	.....	....		37 34·01
	23	B.J. 581.......		"	38 57·40		57·64	59·61	1·97		38 59·59
	24	B.J. 583.......		"	42 01·66		01·80	03·74	1·94		42 03·75
	25	B.J. 584.......		"	44 40·95		41·11	43·05	1·94		44 43·06
	26	χ Herculis....		"	49 33·57		34·01	.....	....		49 35·96
	27	B.J. 591.......		"	52 17·37		17·51	19·48	1·97		52 19·46
	28	B.J. 593.......		"	53 51·27		51·52	53·51	1·99		53 53·47
	29	B.J. 595.......		"	55 39·30		39·89	41·84	....		55 41·84
	30	*r* Herculis		"	57 11·31		11·47	.....	....		57 13·42
	31	B.J. 598.......		"	16 00 12·25		12·93	14·96	....		16 00 14·88
	32	κ Herculis.....		"	04 00·42		00·57	.....	....		04 02·52
	33	B.J. 601.......		"	05 55·89		56·36	58·25	....		05 58·31
	34	Groom. 750...	L.C.	"	07 47·69		42·17	44·69	2·52		....
	35	σ^2 Cor. Bor...		"	11 18·27		18·59	.....	....		11 20·54
	36	B.J. 608.......		"	17 02·00		02·43	04·39	....		17 04·38
June 10	37	B.J. 527.......		N	14 12 57·08	·003	57·60	59·73	....	2·14	14 12 59·74
	38	*f* Boötis		"	22 15·36	(·486)	15·53	.....	....		22 17·67
	39	204 B. Boötis..		"	26 03·26		03·71	.....	....		26 05·85
	40	B.J. 534.......		"	27 56·33		56·62	58·76	2·14		27 58·76
	41	B.J. 535.......		"	28 26·54		26·94	29·09	2·15		28 29·08
	42	σ Boötis......		"	30 44·95		45·23	.....	....		30 47·37
	43	B.J. 540.......		"	35 28·63		29·12	31·28	2·16		35 31·26
	44	B.J. 543.......		"	36 50·36		50·47	52·57	2·10		36 52·61
	45	34 Boötis.....		"	39 27·31		27·56	.....	....		39 29·70
	46	ε Boötis.......		"	41 02·74		02·99	.....	....		41 05·13
	47	295 B. Boötis .		"	45 34·04		34·43	.....	....		45 36·57
	48	ξ Boötis.......		"	47 13·39		13·56	.....	....		47 15·70
	49	B.J. 549.......		"	49 08·97		09·80	11·96	....		49 11·94

From June 9 Clamp West; from June 10 Clamp East.
1–36. Adopted $\Delta T+m=1{\cdot}942+{\cdot}0035\ (T-14^h\ 40^m)$.
37–49. Adopted $\Delta T+m=2{\cdot}146+{\cdot}0036\ (T-15^h\ 10^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 10	1	B.J. 551.......		N	14 51 57·62	·003	57·74	59·91	2·17	2·14	14 51 59·88
	2	B.J. 555......		“	58 32·79	(·486)	33·22	35·33	2·11	2·15	58 35·37
	3	B.J. 557......		“	15 00 34·68		34·93	37·07	2·14		15 00 37·08
	4	c Boötis.......		“	03 20·20		20·43	......	......		03 22·58
	5	Groom. 2283..		“	06 13·37		24·60	27·21	2·61		....
	6	B.J. 563.......		“	11 51·84		52·17	54·32	2·15		11 54·32
	7	B.J. 568.......		“	21 04·81		05·19	07·37	2·18		21 07·34
	8	B.J. 571.......		“	22 55·36		56·18	58·39	......		22 58·33
	9	B.J. 572.....		“	24 06·47		06·74	08·92	2·18		24 08·89
	10	B.J. 573......		“	27 41·25		41·68	43·84	2·16		27 43·83
	11	ν^2 Boötis......		“	28 33·21		33·65	......	......		28 35·80
	12	B.J. 576.......		“	29 17·48		17·78	19·89	2·11		29 19·93
	13	B.J. 578......		“	30 52·00		52·25	54·44	2·19		30 54·40
	14	B.J. 580.......		“	34 35·17		35·60	37·73	2·13		34 37·75
	15	ζ Cor. Bor....		“	35 58·76		59·13	......	......		36 01·28
	16	ι Serpentis....		“	37 31·69		31·86	......	......		37 34·01
	17	B.J. 581.......		“	38 57·20		57·44	59·61	2·17		38 59·59
	18	B.J. 583.......		“	42 01·37		01·50	03·74	2·24		42 03·65
	19	B.J. 584.......		“	44 40·72		40·88	43·05	2·17		44 43·03
	20	χ Herculis....		“	49 33·30		33·76	......	......		49 35·91
	21	B.J. 591.......		“	52 17·17		17·31	19·48	2·17		52 19·46
	22	B.J. 593.......		“	53 51·13		51·38	53·51	2·13		53 53·53
	23	B.J. 595.......		“	55 38·88		39·58	41·83	......		55 41·73
	24	r Herculis.....		“	57 11·16		11·32	......	......		57 13·47
	25	B.J. 598.......		“	16 00 11·89		12·69	14·95	......		16 00 14·84
	26	κ Herculis.....		“	04 00·22		00·37	......	......		04 02·52
	27	τ Cor. Bor....		“	05 40·25		40·62	......	......		05 42·77
	28	Groom. 750...	L.C.	“	07 47·79	——	42·40	44·83	2·43	——	....
June 13	29	B.J. 497.......		N	13 20 17·22	·002	17·95	20·14	......	2·25	13 20 20·20
	30	α Urs. Min....	L.C.	“	26 31·96	(·503)	09·75	14·42	4·67		....
	31	B.J. 502.......		“	30 45·67	(·464)*	46·06	48·25	2·19		30 48·31
	32	B.J. 507.......		“	42 57·94		58·10	00·43	2·33		43 00·35
	33	B.J. 509.......		“	43 58·77		59·36	01·60	......		44 01·61
	34	B.J. 513......		“	50 22·91		23·08	25·32	2·24		50 25·33
	35	B.J. 517.......		“	57 04·62		04·89	07·15	2·26		57 07·14
	36	9 H. Boötis...		S	14 04 18·92		19·41	......	......	2·28*	14 04 21·69
	37	B.J. 522.......		N	06 16·68		16·92	19·19	2·27		06 19·17
	38	B.J. 526.......		“	11 32·35		32·53	34·78	2·25		11 34·78
	39	B.J. 528.......		S	12 58·00		58·55	00·82	......		13 00·83
	40	B.J. 531.......		N	22 07·29		07·94	10·14	......		22 10·19
	41	g Boötis......		S	25 29·21		29·74	......	......		25 32·02
	42	B.J. 534.......		N	27 56·17		56·47	58·74	2·27		27 58·72
	43	B.J. 535.......		“	28 26·41		26·81	29·06	2·25		28 29·06
	44	σ Boötis......		S	30 44·81		45·11	......	......		30 47·39
	45	B.J. 540.......		N	35 28·42		28·92	31·24	2·32		35 31·17
	46	B.J. 543.......		“	36 50·22		50·34	52·56	2·22		36 52·59
	47	34 Boötis.....		“	39 27·14		27·40	......	......		39 29·65
	48	ε Boötis.......		“	41 02·61		02·87	......	......		41 05·12
	49	295 B. Boötis..		S	45 33·89		34·29	......	......		45 36·57

Clamp East.

For polar deviation and adopted $\Delta T+m$ the unmarked values are for observations by N, those marked * for observations by S.

1–28. Adopted $\Delta T+m=2{\cdot}146+{\cdot}0036$ ($T-15^h\ 10^m$).

29–49. Adopted $\Delta T+m$ for observations by $N=2{\cdot}253+{\cdot}0036$ ($T-15^h\ 10^m$); for observations by $S=2{\cdot}282+{\cdot}0036$ ($T-15^h\ 45^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 13	1	ξ Boötis		N	14 47 13·28	·002	13·46	.....	....	2·25	14 47 15·71
	2	B.J. 549		"	49 08·85	(·503)	09·71	11·90	....		49 11·96
	3	B.J. 551		"	51 57·49	(·464)*	57·61	59·90	2·29		51 59·86
	4	B.J. 555		S	58 32·62		33·05	35·31	2·26	2·28*	58 35·33
	5	B.J. 557		N	15 00 34·57		34·83	37·06	2·23		15 00 37·08
	6	Groom. 2283		S	06 13·31		23·43	26·34	2·91		....
	7	B.J. 563		N	11 51·69		52·03	54·31	2·28		11 54·28
	8	η Cor. Bor.		"	19 28·45		28·75	...	......		19 31·00
	9	B.J. 568		S	21 04·69		05·08	07·36	2·28		21 07·36
	10	B.J. 571		"	22 55·26		55·99	58·34	.....		22 58·27
	11	B.J. 572		N	24 06·38		06·66	08·91	2·25		24 08·91
	12	B.J. 573		"	27 41·18		41·62	43·82	2·20		27 43·87
	13	ν^2 Boötis		"	28 32·99		33·43	...	.....		28 35·68
	14	B.J. 576		S	29 17·23		17·55	19·88	2·33		29 19·83
	15	B.J. 578		N	30 51·95		52·21	54·43	2·22		30 54·46
	16	B.J. 580		S	34 34·98		35·41	37·72	2·31		34 37·69
	17	ζ Cor. Bor.		N	35 58·63		59·01	.....	....		36 01·26
	18	ι Serpentis		"	37 31·65		31·83	.....	....		37 34·08
	19	B.J. 581		"	38 57·06		57·31	59·61	2·30		38 59·56
	20	B.J. 583		"	42 01·33		01·46	03·74	2·28		42 03·71
	21	B.J. 584		"	44 40·59		40·76	43·05	2·29	2·26	44 43·02
	22	χ Herculis		S	49 33·19		33·66	...	.....	2·28*	49 35·94
	23	B.J. 591		N	52 17·11		17·25	19·49	2·24		52 19·51
	24	B.J. 593		"	53 50·96		51·22	53·51	2·29		53 53·48
	25	B.J. 595		S	55 38·90		39·52	41·80	....		55 41·80
	26	r Herculis		N	57 11·04		11·21	.....	....		57 13·47
	27	B.J. 598		"	16 00 11·87		12·70	14·91	....		16 00 14·96
	28	κ Herculis		"	04 00·12		00·27	....	....		04 02·53
	29	τ Cor. Bor.		"	05 40·18		40·56	....	......		05 42·82
	30	Groom. 750	L.C.	S	07 47·93		42·55	45·21	2·66		....
	31	σ^2 Cor. Bor.		N	11 17·92		18·26	....	......		11 20·52
	32	B.J. 608		"	17 01·53		02·06	04·38	....		17 04·32
	33	ξ Cor. Bor.		"	18 34·81		35·11	.....	....		18 37·37
	34	23 Herculis		S	19 28·46		28·79	....	....		19 31·07
	35	B.J. 613		N	21 15·06		15·18	17·50	2·32		21 17·44
	36	g Herculis		"	25 40·54		40·99	.....	......		25 43·25
	37	B.J. 621		S	31 11·46		11·93	14·27	2·34		31 14·21
	38	ζ Herculis		N	37 53·02		53·33	.....	....		37 55·59
	39	B.J. 626		"	39 48·05		48·46	50·72	2·26		39 50·72
	40	B.J. 627		S	43 35·09		35·76	38·08	......	2·29*	43 38·05
	41	B.J. 629		N	47 58·56		58·69	00·81	2·12	2·26	48 00·95
	42	53 Herculis		"	49 32·60		32·91	.....	....		49 35·17
	43	ε Urs. Min.		"	55 12·72		16·30	18·85	2·55		....
June 15	44	α Urs. Min.	L.C.	S	13 26 33·25	·028	12·14	16·22	4·08	2·48	....
	45	B.J. 502		"	30 45·39	(·431)	45·79	48·23	2·44		13 30 48·27
	46	B.J. 507		"	42 57·74		57·93	00·42	2·49		43 00·41
	47	B.J. 509		"	43 58·56		59·08	01·56	....		44 01·56
	48	B.J. 513		"	50 22·64		22·84	25·31	2·47	2·49	50 25·33
	49	B.J. 526		"	14 11 32·11		32·32	34·77	2·45		14 11 34·81

Clamp East.

1–43. For polar deviation and adopted $\Delta T+m$ the unmarked values are for observations by N, those marked * for observations by S.

1–43. Adopted $\Delta T+m$ for observations by N$=2{\cdot}253+{\cdot}0036$ (T$-15^h\ 10^m$); for observations by S$=2{\cdot}282+{\cdot}0036$ (T$-15^h\ 45^m$).

44–49. Adopted $\Delta T+m=2{\cdot}490+{\cdot}0036$ (T$-15^h\ 10^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 15	1	B.J. 531.......		S	14 22 07·08	·028	07·65	10·11	....	2·49	14 22 10·14
	2	B.J. 534.......		"	27 55·91	(·431)	56·23	58·73	2·50		27 58·72
	3	B.J. 535.......		"	28 26·11		26·52	29·04	2·52		28 29·01
	4	B.J. 540.......		"	35 28·20		28·70	31·22	2·52		35 31·19
	5	B.J. 543.......		"	36 49·93		50·08	52·56	2·48		36 52·57
	6	34 Boötis.....		"	39 26·91		27·18	.....	....		39 29·67
	7	ε Boötis.......		"	41 02·25		02·54	.....	....		41 05·03
	8	ξ Boötis.......		"	47 12·99		13·19	.....	....		47 15·68
	9	B.J. 549.......		"	49 08·62		09·36	11·86	....		49 11·85
	10	B.J. 551.......		"	51 57·20		57·35	59·89	2·54		51 59·84
	11	B.J. 557.......		"	15 00 34·29		34·58	37·05	2·47		15 00 37·07
	12	B.J. 563.......		"	11 51·45		51·80	54·30	2·50		11 54·29
	13	η Cor. Bor....		"	19 28·17		28·48	.....	....		19 30·97
	14	B.J. 572.......		"	24 06·08		06·38	08·90	2·52		24 08·87
	15	B.J. 573.......		"	27 40·80		41·24	43·81	2·57		27 43·73
	16	ν^2 Boötis......		"	28 32·70		33·15	.....	....		28 35·64
	17	B.J. 578.......		"	30 51·70		51·97	54·43	2·46		30 54·46
	18	ζ Cor. Bor....		"	35 58·34		58·73	.....	....		36 01·22
	19	ι Serpentis....		"	37 31·31		31·52	.....	....		37 34·01
	20	B.J. 581.......		"	38 56·82		57·10	59·60	2·50		38 59·59
	21	B.J. 583.......		"	42 01·08		01·24	03·74	2·50		42 03·73
	22	B.J. 584.......		"	44 40·30		40·49	43·05	2·56		44 42·98
	23	B.J. 591.......		"	52 16·82		16·99	19·49	2·50		52 19·48
	24	B.J. 593.......		"	53 50·72		50·99	53·51	2·52		53 53·48
	25	r Herculis.....		"	57 10·71		10·90	.....	....		57 13·39
	26	B.J. 598.......		"	16 00 11·62		12·33	14·89	....		16 00 14·82
	27	κ Herculis.....		"	03 59·91		00·09	.....	....		04 02·58
	28	τ Cor. Bor....		"	05 39·91		40·30	.....	....		05 42·79
	29	σ^2 Cor. Bor....		"	11 17·64		17·99	.....	....		11 20·48
	30	B.J. 608.......		"	17 01·44		01·91	04·38	....		17 04·40
	31	ξ Cor. Bor.....		"	18 34·58		34·90	.....	....		18 37·39
	32	B.J. 613.......		"	21 14·88		15·03	17·51	2·48		21 17·52
	33	B.J. 614.......		"	22 26·58		27·21	29·83	....		22 29·70
	34	g Herculis.....		"	25 40·34		40·80	.....	....		25 43·29
	35	ζ Herculis.....		"	37 52·76		53·10	.....	....	2·50	37 55·60
	36	B.J. 626.......		"	39 47·84		48·26	50·73	2·47		39 50·76
	37	B.J. 629.......		"	47 58·24		58·40	00·82	2·42		48 00·90
	38	53 Herculis....		"	49 32·41		32·74	.....	....		49 35·24
	39	ε Urs. Min.....		"	55 12·97		16·05	18·79	2·74		....
June 18	40	α Urs. Min....	L.C.	N	13 26 32·04	−·020	15·55	19·36	3·81	2·73	....
	41	25 Can. Ven...		"	33 26·26	(·373)	26·52	.....	....		13 33 29·25
	42	B.J. 507.......		"	42 57·55	(·350)*	57·66	00·40	2·74		43 00·39
	43	B.J. 509.......		"	43 58·36		58·77	01·51	....		44 01·50
	44	B.J. 513.......		"	50 22·41		22·53	25·29	2·76	2·74	50 25·27
	45	B.J. 517.......		"	57 04·17		04·35	07·11	2·76		57 07·09
	46	9 H. Boötis...		S	14 04 18·50		18·85	.....	....	2·77*	14 04 21·62
	47	B.J. 522.......		N	06 16·24		16·41	19·15	2·74		06 19·15
	48	B.J. 526.......		"	11 31·87		31·99	34·75	2·76		11 34·73
	49	B.J. 528.......		S	12 57·57		57·94	00·73	....		13 00·71

From June 15 Clamp East; from June 18 Clamp West.
1—39. Adopted $\Delta T+m=2{\cdot}490+{\cdot}0036$ (T—15h 10m).
40—49. For polar deviation and adopted $\Delta T+m$ the unmarked values are for observations by N, those marked * for observations by S.
40—49. Adopted $\Delta T+m$ for observations by N=2·740+·0037 (T—15h 10m); for observations by S=2·772+·0037 (T—15h 45m).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit.	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 18	1	B.J. 531.......		N	14 22 06·90	—·020	07·35	10·05	....	2·74	14 22 10·09
	2	g Boötis		S	25 28·87	(·373)	29·22	....	....	2·77*	25 31·99
	3	B.J. 534.......		N	27 55·77	(·350)*	55·97	58·71	2·74		27 58·71
	4	B.J. 535.......		"	28 26·07		26·35	29·01	2·66		28 29·09
	5	σ Boötis..		S	30 44·34		44·55	....	....		30 47·32
	6	B.J. 540.......		N	35 28·14		28·48	31·18	2·70		35 31·22
	7	B.J. 543.......		"	36 49·72		49·80	52·54	2·74		36 52·54
	8	34 Boötis.....		"	39 26·78		26·96	....	....		39 29·70
	9	ε Boötis.......		"	41 02·10		02·28	....	....		41 05·02
	10	295 B. Boötis..		S	45 33·47		33·76	....	....		45 36·53
	11	ξ Boötis		N	47 12·80		12·92	....	....		47 15·66
	12	B.J. 549.......		"	49 08·48		09·09	11·80	....		49 11·83
	13	B.J. 551.......		"	51 56·99		57·08	59·88	2·80		51 59·82
	14	B.J. 555.......		S	58 32·19		32·50	35·27	2·77		58 35·27
	15	B.J. 557.......		N	15 00 34·09		34·27	37·03	2·76		15 00 37·01
	16	Groom. 2283..		S	06 13·42		21·08	24·61	3·53		....
	17	B.J. 563.......		N	11 51·37		51·60	54·28	2·68		11 54·34
	18	η Cor. Bor....		"	19 28·09		28·29	....	....		19 31·03
	19	B.J. 568.......		S	21 04·26		04·54	07·33	2·79		21 07·31
	20	B.J. 571.......		"	22 55·00		55·51	58·26	....		22 58·28
	21	B.J. 572.......		N	24 05·94		06·13	08·89	2·76		24 08·87
	22	B.J. 573.......		"	27 40·76		41·06	43·79	2·73		27 43·80
	23	ν^2 Boötis......		"	28 32·64		32·95	....	....		28 35·69
	24	B.J. 576.......		S	29 16·86		17·09	19·86	2·77		29 19·86
	25	B.J. 578.......		N	30 51·51		51·69	54·42	2·73		30 54·43
	26	B.J. 580.......		S	34 34·57		34·88	37·69	2·81		34 37·65
	27	ζ Cor. Bor....		N	35 58·30		58·56	....	....		36 01·30
	28	ι Serpentis....		"	37 31·19		31·31	....	....		37 34·05
	29	B.J. 581.......		"	38 56·64		56·82	59·60	2·78		38 59·56
	30	B.J. 583.......		"	42 00·91		01·00	03·74	2·74		42 03·74
	31	B.J. 584.......		"	44 40·17		40·28	43·05	2·77		44 43·02
	32	χ Herculis....		S	49 32·80		33·13	....	....		49 35·90
	33	B.J. 591.......		N	52 16·68		16·78	19·49	2·71		52 19·52
	34	B.J. 593.......		"	53 50·52		50·70	53·51	2·81		53 53·44
	35	B.J. 595.......		S	55 38·56		38·99	41·76	....		55 41·76
	36	r Herculis		N	57 10·51		10·62	....	....		57 13·36
	37	B.J. 598.......		"	16 00 11·41		12·00	14·86	....		16 00 14·74
	38	κ Herculis.....		"	03 59·64		59·75	....	....		04 02·49
	39	τ Cor. Bor....		"	05 39·80		40·06	....	....		05 42·80
	40	Groom. 750...	L.C.	S	07 46·83		42·67	45·91	3·24		....
	41	σ^2 Cor. Bor....		N	11 17·48		17·71	....	....		11 20·45
	42	B.J. 608.......		"	17 01·28		01·65	04·37	....		17 04·39
	43	ξ Cor. Bor....		"	18 34·44		34·64	....	....		18 37·38
	44	23 Herculis....		S	19 28·17		28·40	....	....		19 31·17
	45	g Herculis		N	25 40·22		40·54	....	....		25 43·28
	46	B.J. 621.......		S	31 11·11		11·44	14·27	2·83		31 14·21
	47	42 Herculis....		"	36 17·46		17·80	....	....	2·78*	36 20·58
	48	ζ Herculis.....		N	37 52·62		52·83	....	....	2·75	37 55·58
	49	B.J. 626.......		"	39 47·68		47·96	50·73	2·77		39 50·71
	50	B.J. 627.......		S	43 34 81		35·27	38·06	....		43 38·05

Clamp West.

For polar deviation and adopted $\Delta T+m$ the unmarked values are for observations by N, those marked * for observations by S.

Adopted $\Delta T+m$ for observations by N=2·740+·0037 (T−15^h 10^m); for observations by S=2·772 +·0037 (T−15^h 45^m).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 18	1	53 Herculis....		N	16 49 32·32	—·020	32·53	.....	....	2·75	16 49 35·28
	2	ϵ Urs. Min.....		"	55 13·13	(·373)	15·80	18·66	2·86	—	....
June 19	3	α Urs. Min....	L.C.	S	13 26 33·81	—·023	16·90	20·49	3·59	2·84	....
	4	B.J. 502.......		"	30 45·07	(·362)	45·35	48·18	2·83		13 30 48·19
	5	25 Can. Ven...		"	33 26·08	(·374)*	26·35	...	....		33 29·19
	6	B.J. 507.......		"	42 57·38		57·51	00·39	2·88		43 00·35
	7	B.J. 509.......		"	43 58·24		58·60	01·49	....		44 01·44
	8	B.J. 513.......		"	50 22·30		22·43	25·28	2·85		50 25·27
	9	B.J. 517.......		"	57 04·03		04·23	07·10	2·87		57 07·07
	10	9 H. Boötis...		N	14 04 18·51		18·85	....	....	2·79*	14 04 21·64
	11	B.J. 522.......		S	06 16·10		16·28	19·14	2·86		06 19·12
	12	B.J. 526.......		"	11 31·74		31·88	34·74	2·86		11 34·72
	13	B.J. 528.......		N	12 57·51		57·95	00·72	....		13 00·74
	14	B.J. 531.......		S	22 06·78		07·18	10·03	....		22 10·02
	15	g Boötis......		N	25 28·84		29·26	.....	....		25 32·05
	16	B.J. 534.......		S	27 55·63		55·86	58·70	2·84		27 58·70
	17	B.J. 535.......		"	28 25·85		26·14	29·00	2·86		28 28·98
	18	σ Boötis......		N	30 44·32		44·52	.....	....		30 47·31
	19	B.J. 540.......		S	35 27·94		28·30	31·17	2·87		35 31·14
	20	B.J. 543.......		"	36 49·59		49·69	52·54	2·85		36 52·53
	21	34 Boötis....		"	39 26·60		26·79	.....	....		39 29·63
	22	ϵ Boötis		"	41 02·02		02·22	.....	....		41 05·06
	23	295 B. Boötis		N	45 33·43		33·59	.....	....		45 36·38
	24	ξ Boötis		S	47 12·72		12·86	.....	....		47 15·70
	25	B.J. 549.......		"	49 08·42		08·95	11·77	....		49 11·79
	26	B.J. 551.......		"	51 56·94		57·04	59·88	2·84		51 59·88
	27	B.J. 555.......		N	58 32·13		32·42	35·26	2·84	2·80*	58 35·22
	28	B.J. 557.......		S	15 00 34·00		34·20	37·03	2·83	2·84	15 00 37·04
	29	Groom. 2283..		N	06 12·26		20·95	24·18	3·23		....
	30	B.J. 563.......		S	11 51·19		51·43	54·28	2·85		11 54·27
	31	η Cor. Bor....		"	19 27·92		28·14	.....	....		19 30·98
	32	B.J. 568.......		N	21 04·30		04·56	07·33	2·77		21 07·36
	33	B.J. 571.......		"	22 54·95		55·54	58·24	....		22 58·34
	34	B.J. 572.......		S	24 05·83		06·04	08·89	2·85		24 08·88
	35	B.J. 573.......		"	27 40·59		40·90	43·79	2·89		27 43·74
	36	ν² Boötis......		"	28 32·48		32·80	.....	....		28 35·64
	37	B.J. 576.......		N	29 16·85		17·06	19·86	2·80		29 19·86
	38	B.J. 578.......		S	30 51·42		51·61	54·42	2·81		30 54·45
	39	B.J. 580.......		N	34 34·50		34·79	37·69	2·90		34 37·59
	40	ζ Cor. Bor.....		S	35 58·08		58·35	.....	....		36 01·19
	41	ι Serpentis...		"	37 31·02		31·16	.....	....		37 34·00
	42	B.J. 581.......		"	38 56·57		56·76	59·60	2·84		38 59·60
	43	B.J. 583.......		"	42 00·78		00·89	03·74	2·85		42 03·73
	44	B.J. 584.......		"	44 40·07		40·20	43·05	2·85	2·85	44 43·05
	45	χ Herculis....		N	49 32·77		33·08	.....	....	2·80*	49 35·88
	46	B.J. 591.......		S	52 16·57		16·68	19·49	2·81		52 19·53
	47	B.J. 593.......		"	53 50·50		50·69	53·51	2·82		53 53·54
	48	B.J. 595.......		N	55 38·49		38·99	41·75	....		55 41·79
	49	r Herculis		S	57 10·48		10·61	.....	....		57 13·46

Clamp West.

1, 2. Adopted $\Delta T+m=2·740+·0037\ (T-15^h\ 10^m)$.

3—49. For polar deviation and adopted $\Delta T+m$ the unmarked values are for observations by S, those marked * for observations by N.

3—49. Adopted $\Delta T+m$ for observations by $S=2·843+·0037\ (T-15^h\ 10^m)$; for observations by $N=2·798+·0037\ (T-15^h\ 45^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 19	1	B.J. 598.......		S	16 00 11·44	—·023	11·96	14·85	....	2·85	16 00 14·81
	2	κ Herculis.....		"	03 59·65	(·362)	59·77	.....	....		04 02·62
	3	τ Cor. Bor		"	05 39·69	(·374)*	39·96	.....	....		05 42·81
	4	Groom. 750...	L.C.	N	07 47·18		43·05	46·10	3·05	2·80*	....
	5	σ^2 Cor. Bor....		S	11 17·39		17·64	.....	....		11 20·49
	6	B.J. 608.......		"	17 01·22		01·53	04·37	....		17 04·38
	7	ξ Cor. Bor.....		"	18 34·29		34·52	.....	....		18 37·37
	8	23 Herculis...		N	19 28·21		28·43	.....	....		19 31·23
	9	B.J. 613.......		S	21 14·60		14·70	17·52	2·82		21 17·55
	10	B.J. 614.......		"	22 26·45		26·89	29·81	....		22 29·74
	11	g Herculis		"	25 40·12		40·45	.....	....		25 43·30
	12	B.J. 621.......		N	31 11·17		11·48	14·27	2·79		31 14·28
	13	42 Herculis....		"	36 17·51		17·91	.....	....		36 20·71
	14	ζ Herculis.....		S	37 52·56		52·79	.....	....		37 55·64
	15	B.J. 626.......		"	39 47·59		47·88	50·73	2·85		39 50·73
	16	B.J. 627.......		N	43 34·78		35·32	38·06	....		43 38·12
	17	B.J. 629.......		S	47 57·86		57·97	00·84	2·87		48 00·82
	18	53 Herculis...		"	49 32·18		32·41	.....	....		49 35·26
	19	ϵ Urs. Min.....		"	55 13·24		15·64	18·59	2·95		....
June 25	20	B.J. 531.......		S	14 22 06·53	—·020	07·01	9·91	....	2·96	14 22 09·97
	21	5 Urs. Min....		"	27 41·83	(·417)	43·39	.....	....		27 46·35
	22	σ Boötis......		"	30 44·04		44·29	.....	....		30 47·25
	23	B.D. 80·448...		"	36 05·98		08·19	.....	....		36 11·15
	24	295 B. Boötis..		"	45 33·13		33·47	.....	....		45 36·43
	25	B.J. 550.......		"	50 57·00		58·39	.....	....		51 01·35
	26	Groom. 2184..		"	55 09·95		11·86	.....	....		55 14·82
	27	Groom. 2283..	rn	"	15 06 08·65		18·51	21·56	3·05		....
	28	B.J. 563.......		"	11 51·04		51·33	54·23	2·90		15 11 54·29
	29	11 Urs. Min...		"	17 09·23		10·43	.....	....		17 13·39
	30	B.J. 569.......		"	20 51·44		52·64	.....	....		20 55·60
	31	B.J. 571.......		"	22 54·46		55·09	58·11	....		22 58·05
	32	B.J. 573.......	r	"	27 40·43		40·74	43·73	2·99		27 43·70
	33	ν^2 Boötis......		"	28 32·27		32·65	.....	....		28 35·61
	34	B.J. 576.......		"	29 16·58		16·85	19·82	2·97		29 19·81
	35	θ Urs. Min....		"	34 04·49		06·26	.....	....		34 09·22
	36	B.J. 590.......		"	47 15·67		17·50	.....	....		47 20·46
	37	χ Herculis....	r	"	49 32·56		32·89	.....	....		49 35·85
	38	B.J. 595.......		"	55 38·22		38·75	41·66	....	2·97	55 41·72
	39	B.J. 598.......		"	16 00 11·02		11·64	14·74	....		16 00 14·61
	40	Groom. 750...	L.C.,rn	"	07 49·21		44·57	47·29	2·72		....
	41	B.J. 606.......		"	13 22·93		24·49	.....	....		13 27·46
	42	Groom. 2337..		"	16 01·78		03·09	.....	....		16 06·06
	43	B.J. 612.......	r	"	20 07·71		09·45	.....	....		20 12·42
	44	B.J. 614.......	r	"	22 26·20		26·82	29·74	....		22 29·79
	45	g Herculis		"	25 39·93		40·31	.....	....		25 43·28
	46	Groom. 2372..		"	30 44·46		46·49	.....	....		30 49·46
	47	B.D. 72·734...		"	32 50·68		51·93	.....	....		32 54·90
	48	B.J. 623.......		"	34 31·04		32·81	.....	....		34 35·78
	49	B.J. 626.......		"	39 47·42		47·77	50·72	2·95		39 50·74

Clamp West.

1—19. For polar deviation and adopted $\Delta T+m$ the unmarked values are for observations by S, those marked * for observations by N.

1—19. Adopted $\Delta T+m$ for observations by S$=2{\cdot}843+{\cdot}0037$ (T-15^h 10^m); for observations by N$=2{\cdot}798+{\cdot}0037$ (T-15^h 45^m).

20—49. Adopted $\Delta T+m=2{\cdot}966+{\cdot}0039$ (T-16^h 10^m).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.		s.	h. m. s.
June 25	1	B.D. 79·511...	r	S	16 43 59·97	−·020	02·23	.....	....	2·97	16 44 05 20
	2	Groom. 2391..		"	47 06·75	(·417)	08·52	.....	....		47 11 49
	3	ε Urs. Min.....	rn	"	55 12·33		15·35	18·14	2·79		....
	4	Groom. 2411..		"	58 03·91		05·20	.....	....		58 08·17
	5	Groom. 2427..		"	17 04 30·05		31·53	.....	....		17 04 34·50
	6	B.J. 643.......	r	"	11 53·48		53·74	56·83	3·09		11 56·71
	7	e Herculis.....		"	14 32·86		33·19	.....	....		14 36 16
	8	w Herculis....		"	17 16·32		16·60	.....	....		17 19·57
	9	ρ Herculis.....		"	20 33·51		33·84	.....	....		20 36·81
	10	B.J. 650.......		"	24 20·03		20·44	23·46	....		24 23·41
	11	Groom. 2456..		"	26 27·34		29·60	.....	....		26 32·57
	12	B.J. 653.......		"	28 22·97		23·45	26·42	....		28 26·42
	13	B.J. 655.......		"	30 23·25		23·78	26·85	....		30 26·75
	14	Groom. 944...	L.C.,rn	"	32 50·65		46·18	49·05	2·87		....
	15	B.J. 663.......	r	"	36 54·27		54·71	57·73	....		36 57·68
June 28	16	g Boötis......		S	14 25 27·90	·038	28·54	.....	....	3·25	14 25 31·79
	17	5 Urs. Min....		"	27 40·71	(·510)	42·80	.....	....		27 46·05
	18	σ Boötis......		"	30 43·64		44·01	.....	....		30 47·26
	19	B.D. 80·448...		"	36 04·67		07·60	.....	....		36 10·85
	20	295 B. Boötis..		"	45 32·64		33·12	.....	....		45 36·37
	21	B.J. 549.......		"	49 07·40		08·30	11·55	....		49 11·55
	22	B.J. 550.......		"	50 56·07		57·94	.....	....		51 01·19
	23	Groom. 2184..		"	55 08·76		11·31	.....	....		55 14·56
	24	B.J. 555.......		"	58 31·35		31·88	35·15	3·27		58 35·13
	25	Groom. 2283..	nr	"	15 06 04·52		17·23	20·46	3·23		....
	26	B.J. 563.......		"	11 50·54		50·96	54·21	3·25		15 11 54·21
	27	11 Urs. Min...		"	17 08·44		10·05	.....	....		17 13·30
	28	B.J. 569.......		"	20 50·51		52·12	.....	....		20 55·37
	29	B.J. 571.......		"	22 53·83		54·72	58·05	....		22 57·97
	30	B.J. 573.......		"	27 39·86		40·39	43·71	3·32		27 43·64
	31	B.J. 576.......		"	29 16·13		16·53	19·80	3·27		29 19·78
	32	θ Urs. Min....		"	34 03·40		05·77	.....	....		34 09·02
	33	B.J. 590.......		"	47 14·66		17·10	.....	....		47 20·35
	34	χ Herculis....		"	49 32·01		32·57	.....	....		49 35·82
	35	B.J. 595.......	r	"	55 37·49		38·33	41·61	....		55 41·58
	36	B.J. 598.......		"	16 00 10·50		11·37	14·69	....		16 00 14·62
	37	Groom. 750...	L.C.,nr	"	07 50·42		44·37	47·81	3·44		....
	38	B.J. 606.......	r	"	13 21·82		24·10	.....	....		13 27·35
	39	Groom. 2337..		"	16 00·79		02·55	.....	....		16 05·80
	40	B.J. 614.......		"	22 25·61		26·38	29·71	....		22 29·63
	41	g Herculis.....	r	"	25 39·54		40·03	.....	....		25 43·28
	42	Groom. 2372..	r	"	30 43·02		45·96	.....	....		30 49·21
	43	B.D. 72·734...		"	32 49·81		51·49	.....	....		32 54·74
	44	B.J. 626.......		"	39 46·94		47·44	50·71	3·27	3·26	39 50·70
	45	B.D. 79·511...		"	42 58·96		01·33	.....	....		43 04·59
	46	ε Urs. Min.....	nr	"	55 10·63		14·55	17·93	3·38		....
	47	Groom. 2411..		"	58 02·68		04·41	.....	....		58 07·67
	48	Groom. 2427..		"	17 04 29·08		31·08	.....	....		17 04 34·34
	49	B.J. 643.......		"	11 53·13		53·59	56·83	3·24		11 56·85

From June 25 Clamp West; from June 28 Clamp East.

1—15. Adopted $\Delta T+m=2{\cdot}966+{\cdot}0039\ (T-16^{h}\ 10^{m})$.

16—49. Adopted $\Delta T+m=3{\cdot}253+{\cdot}0039\ (T-16^{h}\ 05^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date.	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 28	1	e Herculis	r	S	17 14 32·39	·038	32·81			3·26	17 14 36·07
	2	w Herculis		"	17 15·86	(·510)	16·27				17 19·53
	3	ρ Herculis		"	20 33·00		33·47				20 36·73
	4	B.J. 650		"	24 19·48		20·08	23·46			24 23·34
	5	Groom. 2456		"	26 26·19		29·19				26 32·45
	6	B.J. 653		"	28 22·57		23·26	26·42			28 26·52
	7	B.J. 655		"	30 22·73		23·49	26·84			30 26·75
	8	B.J. 663	r	"	36 53·81		54·44	57·74			36 57·70
June 29	9	B.J. 549		S	14 49 07·21	·035	08·17	11·52		3·34	14 49 11·51
	10	B.J. 550		"	50 55·80	(·546)	57·79				51 01·13
	11	Groom. 2184		"	55 08·29		11·00				55 14·34
	12	B.J. 555		"	58 31·23		31·78	35·14	3·36		58 35·12
	13	Groom. 2283	rn	"	15 06 03·07		16·57	20·08	3·51		....
	14	B.J. 563		"	11 50·42		50·86	54·20	3·34		15 11 54·20
	15	11 Urs. Min.		"	17 07·98		09·68				17 13·02
	16	η Cor. Bor.		"	19 27·16		27·55				19 30·89
	17	B.J. 569		"	20 50·25		51·97				20 55·31
	18	B.J. 571		"	22 53·66		54·61	58·02			22 57·95
	19	B.J. 573		"	27 39·78		40·34	43·70	3·36		27 43·68
	20	ν² Boötis	r	"	28 31·71		32·21				28 35·55
	21	B.J. 576		"	29 16·04		16·45	19·79	3·34		29 19·79
	22	θ Urs. Min.		"	34 03·19		05·71				34 09·05
	23	B.J. 590		"	47 14·41		17·01				47 20·35
	24	χ Herculis	r	"	49 31·97		32·49				49 35·83
	25	B.J. 595		"	55 37·43		38·24	41·60			55 41·58
	26	B.J. 598		"	16 00 10·32		11·25	14·67			16 00 14·59
	27	Groom. 750	L.C.	"	07 50·85		44·67	48·00	3·33		....
	28	B.J. 606		"	13 21·83		24·06				13 27·40
	29	Groom. 2337		"	16 00·55		02·43				16 05·77
	30	ξ Cor. Bor.		"	18 33·60		34·00				18 37·34
	31	B.J. 612	r	"	20 06·49		08·88				20 12·22
	32	B.J. 614	r	"	22 25·42		26·32	29·70			22 29·66
	33	g Herculis		"	25 39·30		39·88				25 43·22
	34	Groom. 2372		"	30 42·88		45·75				30 49·09
	35	B.D. 72·734		"	32 49·62		51·40				32 54·74
	36	B.J. 626		"	39 46·79		47·31	50·71	3·40	3·35	39 50·66
	37	B.D. 79·511	r	"	42 58·66		01·75				42 05·10
	38	Groom. 2391		"	47 05·39		07·91				47 11·26
	39	53 Herculis		"	49 31·44		31·85				49 35·20
	40	ε Urs. Min.	rn	"	55 10·36		14·53	17·87	3·34		....
	41	Groom. 2411		"	58 02·62		04·46				58 07·81
	42	Groom. 2427		"	17 04 28·75		30·87				17 04 34·22
	43	B.J. 643	r	"	11 53·04		53·47	56·83	3·36		11 56·82
	44	e Herculis		"	14 32·29		32·78				14 36·13
	45	w Herculis		"	17 15·73		16·15				17 19·50
	46	ρ Herculis		"	20 32·91		33·40				20 36·75
	47	B.J. 650	r	"	24 19·33		20·03	23·46			24 23·38
	48	Groom. 2456		"	26 25·82		29·01				26 32·36
	49	B.J. 653		"	28 22·24		22·98	26·42			28 26·33

Clamp East. 1—8. Adopted $\Delta T+m=3{\cdot}253+{\cdot}0039$ (T$-16^h\ 05^m$).

9—49. Adopted $\Delta T+m=3{\cdot}343+{\cdot}0039$ (T$-16^h\ 05^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
June 29	1	B.J. 655.......		S	17 30 22·55	·035	23·37	26·84	....	3·35	17 30 26·72
	2	Groom. 944...	L.C.,rn	"	32 52·28	(·546)	46·04	49·45	3·41		....
	3	B.J. 663.......		"	36 53·78		54·37	57·74	....		36 57·72
July 4	4	χ Herculis....		S	15 49 31·48	·042	32·11	.....	....	3·62	15 49 35·73
	5	B.J. 591.......		"	52 15·56	(·576)	15·79	19·45	3·66		52 19·41
	6	B.J. 593.......		"	53 49·44		49·81	53·43	3·62		53 53·43
	7	B.J. 595.......		"	55 37·01		37·87	41·50	....		55 41·49
	8	r Herculis....		"	57 09·49		09·75	.....	....		57 13·37
	9	B.J. 598.......		"	16 00 09·86		10·85	14·56	....		16 00 14·47
	10	κ Herculis....		"	03 58·67		58·92	.....	....		04 02·54
	11	Groom. 750...	L.C.,nr	"	07 52·27		45·36	49·18	3·82		....
	12	σ^2 Cor. Bor...		"	11 16·27		16·74	.....	....		11 20·36
	13	B.J. 608.......		"	16 59·88		00·52	04·23	....		17 04·14
	14	ξ Cor. Bor.....		"	18 33·23		33·66	.....	....		18 37·28
	15	23 Herculis...		"	19 26·95		27·40	.....	....		19 31·02
	16	B.J. 613.......		"	21 13·65		13·85	17·51	3·66		21 17·47
	17	B.J. 614.......		"	22 25·01		25·89	29·61	....		22 29·51
	18	g Herculis....		"	25 38·98		39·59	.....	....		25 43·21
	19	B.J. 621.......		"	31 09·88		10·51	14·17	3·66		31 14·13
	20	ζ Herculis.....		"	37 51·48		51·92	.....	....		37 55·54
	21	B.J. 626.......		"	39 46·44		47·00	50·67	3·67		39 50·62
	22	B.J. 627.......		"	43 33·32		34·25	37·89	....		43 37·87
	23	B.J. 629.......		"	47 56·98		57·20	00·85	3·65		48 00·82
	24	53 Herculis....		"	49 31·15		31·59	.....	....		49 35·21
	25	ϵ Urs. Min.....	nr	"	55 09·37		13·81	17·38	3·57	3·63	......
	26	d Herculis....		"	58 14·88		15·35	.....	....		58 18·98
	27	B.J. 635.......		"	17 01 10·43		10·62	14·17	3·55		17 01 14·25
	28	B.J. 640.......		"	10 30·76		30·97	34·53	3·56		10 34·60
	29	B.J. 643.......		"	11 52·67		53·19	56·81	3·62		11 56·82
	30	u Herculis....		"	13 58·01		58·46	.....	....		14 02·09
	31	w Herculis....		"	17 15·45		15·90	.....	....		17 19·53
	32	ρ Herculis....		"	20 32·57		33·10	.....	....		20 36·73
	33	B.J. 650.......		"	24 19·09		19·78	23·43	....		24 23·41
	34	λ Herculis.....		"	27 04·06		04·41	.....	....		27 08·04
	35	B.J. 653.......		"	28 21·94		22·73	26·38	....		28 26·36
	36	Groom. 944...	L.C.,nr	"	32 53·52		46·85	50·18	3·33		....
	37	B.J. 663.......		"	36 53·40		54·03	57·72	....		36 57·66
	38	B.J. 667.......		"	42 54·16		54·55	58·16	3·61		42 58·18
	39	87 Herculis....		"	45 08·25		08·60	.....	....		45 12·23
	40	z Herculis....		"	47 40·06		40·75	.....	....		47 44·38
	41	168 H. Herc...		"	49 06·90		07·47	.....	....		49 11·10
	42	89 Herculis....		"	51 45·36		45·71	.....	....		51 49·34
	43	B.J. 672.......		"	53 07·92		08·45	12·12	3·67		53 12·08
	44	B.J. 676.......		"	54 28·96		29·73	33·42	....		54 33·36
	45	δ Urs. Min....	nr	"	18 01 21·83		32·08	35·78	3·70		......
July 5	46	B.J. 551.......		S	14 51 55·91	·032	56·12	59·77	3·65	3·65	14 51 59·77
	47	B.J. 555.......		"	58 30·83	(·597)	31·42	35·05	3·63		58 35·07
	48	B.J. 557.......		"	15 00 32·88		33·25	36·90	3·65	3·66	15 00 36·91

Clamp East.

1—3. Adopted $\Delta T+m=3{\cdot}343+{\cdot}0039\ (T-16^{h}\ 05^{m})$.
4—45. Adopted $\Delta T+m=3{\cdot}625+{\cdot}0040\ (T-16^{h}\ 50^{m})$.
46—48. Adopted $\Delta T+m=3{\cdot}661+{\cdot}0040\ (T-16^{h}\ 30^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
July 5	1	Groom. 2283..	rn	S	15 05 58·93	·032	13·57	17·06	3·49	3·66	....
	2	B.J. 563.......		"	11 49·99	(·597)	50·46	54·13	3·67		15 11 54·12
	3	η Cor. Bor ...		"	19 26·77		27·19	......	....		19 30·85
	4	B.J. 568.......		"	21 02·95		03·49	07·16	3·67		21 07·15
	5	B.J. 571.......		"	22 53·10		54·12	57·87	....		22 57·78
	6	B.J. 572.......		"	24 04·69		05·09	08·76	3·67		24 08·75
	7	B.J. 573.......	r	"	27 39·41		39·95	43·61	3·66		27 43·61
	8	ν^2 Boötis		"	28 31·17		31·78	......	....		28 35·44
	9	B.J. 578.......		"	30 50·31		50·67	54·31	3·64		30 54·33
	10	B.J. 580.......		"	34 33·24		33·83	37·52	3·69		34 37·49
	11	ζ Cor. Bor....		"	35 56·93		57·46	......	....		36 01·12
	12	ι Serpentis.....		"	37 30·03		30·30	......	....		37 33·96
	13	B.J. 581.......		"	38 55·49		55·85	59·50	3·65		38 59·51
	14	B.J. 583.......		"	41 59·81		00·03	03·68	3·65		42 03·69
	15	B.J. 584.......	r	"	44 39·08		39·29	42·98	3·69		44 42·95
	16	χ Herculis.....		"	49 31·47		32·10	......	....		49 35·76
	17	B.J. 591.......		"	52 15·57		15·79	19·44	3·65		52 19·45
	18	B.J. 593.......		"	53 49·43		49·79	53·43	3·64		53 53·45
	19	B.J. 595.......		"	55 36·89		37·76	41·48	....		55 41·42
	20	r Herculis		"	57 09·48		09·74	......	....		57 13·40
	21	B.J. 598.......		"	16 00 09·78		10·78	14·54	....		16 00 14·44
	22	κ Herculis.....		"	03 58·61		58·84	......	....		04 02·50
	23	Groom. 750....	L.C.,rn	"	07 52·30		45·26	49·43	4·17		....
	24	σ^2 Cor Bor...		"	11 16·24		16·72	......	....		11 20·38
	25	B.J. 608.......		"	16 59·88		00·53	04·21	....		17 04·19
	26	ξ Cor. Bor....		"	18 33·16		33·59	......	....		18 37·25
	27	23 Herculis....		"	19 26·94		27·39	......	....		19 31·05
	28	B.J. 613.......		"	21 13·64		13·84	17·50	3·66		21 17·50
	29	B.J. 614.......		"	22 24·93		25·82	29·59	....		22 29·48
	30	g Herculis		"	25 38·89		39·51	......	....		25 43·17
	31	B.J. 621.......		"	31 09·82		10·45	14·16	3·71		31 14·11
	32	42 Herculis...		"	36 16·03		16·74	......	....		36 20·40
	33	ζ Herculis		"	37 51·41		51·85	......	....		37 55·51
	34	B.J. 626.......		"	39 46·45		47·01	50·67	3·66		39 50·67
	35	B.J. 627.......		"	43 33·20		34·14	37·87	....		43 37·80
	36	B.J. 629.......		"	47 56·98		57·19	00·85	3·66		48 00·85
	37	53 Herculis....		"	49 31·10		31·54	......	....		49 35·20
	38	ϵ Urs. Min	rn	"	55 09·00		13·52	17·27	3·75		....
	39	d Herculis		"	58 14·85		15·32	......	....		58 18·98
	40	B.J. 635.......		"	17 01 10·29		10·48	14·17	3·69		17 01 14·14
	41	B.J. 636.......		"	04 48·38		48·97	52·70	3·73		04 52·63
	42	B.J. 640.......		"	10 30·67		30·88	34·53	3·65		10 34·54
	43	B.J. 643.......		"	11 52·59		53·12	56·80	3·68		11 56·78
	44	u Herculis		"	13 57·91		58·37	......	....		14 02·03
	45	w Herculis....		"	17 15·39		15·84	......	....		17 19·50
	46	ρ Herculis		"	20 32·52		33·05	......	....		20 36·71
	47	B.J. 650.......		"	24 18·96		19·65	23·42	....		24 23·31
	48	λ Herculis.....		"	27 04·02		04·37	......	....		27 08·03
	49	B.J. 653.......		"	28 21·80		22·60	26·38	....		28 26·26
	50	B.J. 656.......	r	"	30 43·53		43·66	47·35	3·69	3·67	30 47·33

Clamp East. 1–50. Adopted $\Delta T+m=3{\cdot}661+{\cdot}0040\ (T-16^h\ 30^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
July 5	1	Groom. 944...	L.C.,rn	S	17 32 53·64	·032	46·84	50·37	3·53	3·67	....
	2	B.J. 663.......		"	36 53·34	(·597)	53·98	57·72	....		17 36 57·65
	3	B.J. 667.......		"	42 54·12		54·50	58·16	3·66		42 58·17
	4	87 Herculis...	r	"	45 08·21		08·51	.....	....		45 12·18
	5	z Herculis		"	47 39·97		40·66	.....	....		47 44·33
	6	168 H. Herc...		"	49 06·86		07·44	.....	....		49 11·11
	7	89 Herculis....		"	51 45·30		45·65	.....	....		51 49·32
	8	B.J. 672.......		"	53 07·90		08·43	12·12	3·69		53 12·10
	9	B.J. 674.......		"	54 14·00		14·40	18·11	3·71		54 18·07
	10	δ Urs. Min	rn	"	18 01 21·07		31·51	35·59	4·08		....
	11	B.J. 681.......		"	03 59·90		00·30	03·96	3·66		18 04 03·97
July 6	12	B.J. 555.......		N	14 58 30·74	·038	31·34	35·03	3·69	3·72	14 58 35·06
	13	B.J. 557.......		"	15 00 32·83	(·623)	33·20	36·89	3·69		15 00 36·92
	14	Groom. 2283..	nr	"	05 57·55		12·95	16·53	3·58		....
	15	B.J. 563.......		"	11 49·91		50·38	54·12	3·74		11 54·10
	16	B.J. 568.......		"	21 02·92		03·45	07·15	3·70		21 07·17
	17	B.J. 571.......		"	22 52·93		54·06	57·84	....		22 57·78
	18	B.J. 572.......		"	24 04·68		05·08	08·75	3·67		24 08·80
	19	B.J. 573.......		"	27 39·28		39·88	43·60	3·72		27 43·60
	20	ν^2 Boötis.....	r	"	28 31·14		31·74	.....	....		28 35·46
	21	B.J. 578.......		"	30 50·25		50·61	54·30	3·69		30 54·33
	22	B.J. 580.......		"	34 33·15		33·75	37·51	3·76		34 37·47
	23	ζ Cor. Bor....		"	35 56·81		57·33	.....	....		36 01·05
	24	ι Serpentis.....		"	37 29·97		30·23	.....	....		37 33·95
	25	B.J. 581.......		"	38 55·42		55·77	59·49	3·72		38 59·49
	26	B.J. 583.......		"	41 59·72		59·93	03·68	3·75		42 03·65
	27	B.J. 584.......	r	"	44 38·95		39·20	42·98	3·78		44 42·92
	28	χ Herculis....		"	49 31·38		32·01	.....	....		49 35·73
	29	B.J. 591.......		"	52 15·49		15·71	19·43	3·72		52 19·43
	30	B.J. 593.......		"	53 49·28		49·64	53·42	3·78		53 53·36
	31	B.J. 595.......		"	55 36·79		37·75	41·46	....		55 41·47
	32	r Herculis		"	57 09·36		09·61	.....	....		57 13·33
	33	B.J. 598.......		"	16 00 09·59		10·70	14·51	....	3·73	16 00 14·43
	34	κ Herculis		"	03 58·55		58·78	.....	....		04 02·51
	35	τ Cor. Bor....		"	05 38·48		39·00	.....	....		05 42·73
	36	Groom. 750...	L.C.	"	07 52·92		45·48	49·70	4·22		....
	37	σ^2 Cor. Bor...		"	11 16·18		16·65	.....	....		11 20·38
	38	B.J. 608.......		"	16 59·69		00·41	04·20	....		17 04·14
	39	ξ Cor. Bor.....		"	18 33·05		33·47	.....	....		18 37·20
	40	23 Herculis....		"	19 26·91		27·36	.....	....		19 31·09
	41	B.J. 613.......		"	21 13·59		13·78	17·50	3·72		21 17·51
	42	B.J. 614.......		"	22 24·86		25·83	29·57	....		22 29·56
	43	g Herculis		"	25 38·77		39·39	.....	....		25 43·12
	44	B.J. 618.......		"	26 18·83		19·12	22·86	3·74		26 22·85
	45	B.J. 621.......		"	31 09·73		10·36	14·15	3·79		31 14·09
	46	ζ Herculis.....		"	37 51·35		51·79	.....	....		37 55·52
	47	B.J. 626.......		"	39 46·38		46·94	50·66	3·72		39 50·67
	48	B.J. 627.......		"	43 32·97		34·00	37·85	....		43 37·73
	49	B.J. 629.......		"	47 56·88		57·09	00·85	3·76		48 00·82

Clamp East. 1—11. Adopted $\Delta T+m=3{\cdot}661+{\cdot}0040$ (T-16^h 30^m).
12—49. Adopted $\Delta T+m=3{\cdot}725+{\cdot}0040$ (T-16^h 00^m).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
July 6	1	53 Herculis...		N	16 49 30·98	·038	31·42	.....	....	3·73	16 49 35·15
	2	ε Urs. Min.....		"	55 08·39	(·623)	13·14	17·16	4·02		....
	3	d Herculis		"	58 14·79		15·26	.....	....		58 18·99
	4	B.J. 635.......		"	17 01 10·24		10·41	14·17	3·76		17 01 14·14
	5	B.J. 636.......		"	04 48·31		48·91	52·69	3·78		04 52·64
July 11	6	11 Urs. Min...		N	15 17 06·67	·037	08·54	.....	....	4·25	15 17 12·79
	7	η Cor. Bor. ...		"	19 26·22	(·568)	26·61	.....	....		19 30·86
	8	B.J. 571.......		"	22 52·40		53·42	57·70	....		22 57·67
	9	B.J. 573.......	r	"	27 38·74		39·29	43·52	4·23		27 43·54
	10	ν^2 Boötis		"	28 30·61		31·17	.....	....		28 35·42
	11	θ Urs. Min.....		"	34 01·08		03·82	.....	....		34 08·07
	12	ι Serpentis		"	37 29·39		29·63	.....	....		37 33·88
	13	B.J. 581.......		"	38 54·88		55·20	59·45	4·25		38 59·45
	14	B.J. 583.......	r	"	41 59·21		59·40	03·64	4·24		42 03·65
	15	B.J. 584.......		"	44 38·43		38·66	42·94	4·28		44 42·91
	16	B.J. 590.......		"	47 12·23		15·06	.....	....		47 19·31
	17	χ Herculis....		"	49 30·79		31·37	.....	....		49 35·62
	18	B.J. 591.......		"	52 14·97		15·17	19·40	4·23		52 19·42
	19	B.J. 593.......		"	53 48·74		49·07	53·38	4·31		53 53·32
	20	B.J. 595.......		"	55 36·21		37·09	41·36	....		55 41·34
	21	r Herculis		"	57 08·79		09·02	.....	....		57 13·27
	22	B.J. 598.......		"	16 00 09·00		10·01	14·39	....		16 00 14·26
	23	Groom. 750...	L.C.	"	07 52·80		46·04	50·83	4·79	4·26	....
	24	σ^2 Cor. Bor...		"	11 15·67		16·11	.....	....		11 20·37
	25	B.J. 606.......		"	13 20·05		22·47	.....	....		13 26·73
	26	ξ Cor. Bor. ...		"	18 32·57		32·96	.....	....		18 37·22
	27	B.J. 612.......		"	20 04·90		07·29	.....	....		20 11·55
	28	B.J. 614.......	r	"	22 24·31		25·20	29·47	....		22 29·46
	29	g Herculis		"	25 38·28		38·85	.....	....		25 43·11
	30	Groom. 2372..		"	30 41·03		44·15	.....	....		30 48·41
	31	B.D. 72·734...		"	32 48·13		50·08	.....	....		32 54·34
	32	B.J. 623.......		"	34 27·78		30·52	.....	....		34 34·78
	33	ζ Herculis.....		"	37 50·83		51·23	.....	....		37 55·49
	34	B.J. 626.......		"	39 45·84		46·35	50·62	4·27		39 50·61
	35	B.D. 79·511...	r	"	42 56·81		59·90	.....	....		43 04·16
	36	Groom. 2391..		"	47 03·66		06·40	.....	....		47 10·66
	37	53 Herculis....		"	49 30·54		30·94	.....	....		49 35·20
	38	ε Urs. Min.....		"	55 08·10		12·45	16·64	4·19		....
	39	Groom. 2411..		"	58 01·09		03·09	.....	....		58 07·35
	40	B.J. 635.......		"	17 01 09·73		09·89	14·16	4·27		17 01 14·15
	41	B.D. 75·612...		"	03 11·07		13·37	.....	....		03 17·63
	42	B.J.. 640......		"	10 30·09		30·27	34·52	4·25		10 34·53
	43	B.J. 643.......		"	11 52·01		52·49	56·77	4·28		11 56·75
	44	e Herculis	r	"	14 31·36		31·84	.....	....		14 36·10
	45	ρ Herculis		"	20 32·10		32·58	.....	....		20 36·84
	46	B.J. 650.......		"	24 18·29		18·99	23·38	....		24 23·25
	47	Groom. 2456..		"	26 23·91		27·37	.....	....		26 31·63
	48	Groom. 944...	L.C.	"	32 54·32		47·80	51·38	3·58		....

Clamp East. 1—5. Adopted $\Delta T+m=3{\cdot}725+{\cdot}0040$ ($T-16^h\ 00^m$).
6—48. Adopted $\Delta T+m=4{\cdot}256+{\cdot}0041$ ($T-16^h\ 20^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
July 13	1	B.J. 563		N	15 11 49·10	·034	49·58	54·03	4·45	4·49	15 11 54·07
	2	11 Urs. Min.		"	17 05·98	(·643)	08·07				17 12·56
	3	η Cor. Bor.		"	19 25·85		26·27				19 30·76
	4	B.J. 569		"	20 48·18		50·27				20 54·76
	5	B.J. 571		"	22 51·98		53·13	57·64			22 57·62
	6	B.J. 573		"	27 38·36		38·97	43·49	4·52		27 43·46
	7	ν^2 Boötis	r	"	28 30·25		30·87				28 35·36
	8	B.J. 576		"	29 14·76		15·20	19·64	4·44		29 19·69
	9	B.J. 578		"	30 49·39		49·76	54·23	4·47		30 54·25
	10	θ Urs. Min.		"	34 00·47		03·54				34 08·03
	11	ζ Cor. Bor.		"	35 56·03		56·56				36 01·05
	12	ι Serpentis		"	37 29·11		29·37				37 33·86
	13	B.J. 581		"	38 54·47		54·83	59·42	4·59		38 59·32
	14	B.J. 583		"	41 58·90		59·11	03·62	4·51		42 03·60
	15	B.J. 584	r	"	44 38·11		38·35	42·92	4·57		44 42·84
	16	B.J. 590		"	47 11·84		15·01				47 19·50
	17	χ Herculis		"	49 30·50		31·14				49 35·63
	18	B.J. 591		"	52 14·73		14·95	19·39	4·44		52 19·44
	19	B.J. 593		"	53 48·52		48·89	53·35	4·46		53 53·38
	20	B.J. 595		"	55 35·83		36·81	41·31			55 41·30
	21	r Herculis		"	57 08·69		08·93				57 13·42
	22	B.J. 598		"	16 00 08·54		09·67	14·34			16 00 14·16
	23	κ Herculis		"	03 57·74		57·97				04 02·46
	24	τ Cor. Bor.		"	05 37·65		38·18				05 42·67
	25	Groom. 750	L.C.,nr	"	07 54·31		46·68	51·27	4·59		....
	26	σ^2 Cor. Bor.		"	11 15·34		15·83				11 20·32
	27	B.J. 606		"	13 19·19		21·90				13 26·39
	28	20 Urs. Min.		"	14 43·96		46·55				14 51·04
	29	ξ Cor. Bor.		"	18 32·28		32·71				18 37·20
	30	B.J. 612	r	"	20 04·06		06·74				20 11·23
	31	B.J. 614	r	"	22 23·84		24·83	29·43			22 29·32
	32	g Herculis	r	"	25 38·01		38·64				25 43·13
	33	Groom. 2372		"	30 40·02		43·52				30 48·01
	34	B.D. 72·734		"	32 47·48		49·66				32 54·15
	35	B.J. 623		"	34 27·00		30·07				34 34·56
	36	B.J. 626		"	39 45·52		46·09	50·59	4·50		39 50·58
	37	B.D. 79·511	r	"	42 55·90		59·37				43 03·86
	38	53 Herculis		"	49 30·28		30·72				49 35·21
	39	ϵ Urs. Min.	nr	"	55 07·16		12·03	16·45	4·42		....
	40	Groom. 2411		"	58 00·45		02·69				58 07·18
	41	B.J. 635		"	17 01 09·43		09·61	14·15	4·54		17 01 14·10
	42	B.D. 75·612		"	03 10·49		13·06				03 17·55
	43	Groom. 2427		"	04 26·65		29·23				04 33·72
	44	B.J. 643		"	11 51·78		52·31	56·76	4·45		11 56·80
	45	e Herculis	r	"	14 31·07		31·61			4·50	14 36·11
	46	w Herculis		"	17 14·54		15·00				17 19·50
	47	ρ Herculis		"	20 31·67		32·21				20 36·71
	48	B.J. 650		"	24 18·01		18·79	23·35			24 23·29
	49	Groom. 2456		"	26 23·25		27·13				26 31·63
	50	Groom. 944	L.C.,nr	"	32 54·42		47·05	51·69	4·64		....

Clamp East.

1—50. Adopted $\Delta T+m=4{\cdot}492+{\cdot}0041\ (T-16^{h}\ 30^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
July 13	1	B.J. 663.......		N	17 36 52·49	·034	53·22	57·67	....	4·50	17 36 57·72
	2	B.D. 72·800...		"	38 48·22	(·643)	50·36	.....	....		38 54·86
	3	B.J. 670.......		"	43 29·54		31·63	.....	....		43 36·13
	4	87 Herculis....		"	45 07·43		07·78	.....	....		45 12·28
	5	z Herculis....		"	47 39·02		39·81	.....	....		47 44·31
	6	168 H. Herc...		"	49 06·05		06·64	.....	....		49 11·14
	7	89 Herculis....		"	51 44·53		44·89	.....	....		51 49·39
	8	B.J. 672.......		"	53 07·02		07·56	12·10	4·54		53 12·06
	9	δ Urs. Min....	nr	"	18 01 17·96		29·22	34·21	......		....
July 16	10	53 Herculis....		S	16 49 29·98	·047	30·47	.....	....	4·63	16 49 35·10
	11	ε Urs. Min.....	nr	"	55 06·42	(·650)	11·44	16·11	4·67		....
	12	d Herculis....		"	58 13·77		14·30	....	......		58 18·93
	13	B.J. 635.......		"	17 01 09·32		09·54	14·14	4·60		17 01 14·17
	14	B.J. 636.......		"	04 47·26		47·92	52·61	4·69		04 52·55
	15	B.J. 643.......		"	11 51·53		52·11	56·74	4·63		11 56·74
	16	u Herculis....		"	14 56·87		57·38	.....	....		15 02·01
	17	w Herculis		"	17 14·30		14·81	.....	....		17 19·44
	18	ρ Herculis		"	20 31·46		32·04	.....	....	4·64	20 36·68
	19	B.J. 650.......		"	24 17·82		18·59	23·32	......		24 23·23
	20	λ Herculis....		"	27 03·01		03·41	..	......		27 08·05
	21	B.J. 653.......		"	28 20·66		21·55	26·26	......		28 26·19
	22	B.J. 656.......		"	30 42·53		42·74	47·35	4·61		30 47·38
	23	Groom. 944...	L.C.,nr	"	32 55·25		47·65	52·23	4·58		....
	24	B.J. 663.......		"	36 52·31		53·03	57·64	....		36 57·67
	25	B.J. 667.......	r	"	42 53·12		53·49	58·14	4·65		42 58·13
	26	87 Herculis....		"	45 07·17		07·56	....	....		45 12·20
	27	z Herculis....		"	47 38·87		39·64	.....	....		47 44·28
	28	168 H. Herc...		"	49 05·82		06·47	.....	....		49 11·11
	29	89 Herculis....		"	51 44·34		44·74	.....	....		51 49·38
	30	B.J. 672.......		"	53 06·86		07·44	12·09	4·65		53 12·08
	31	δ Urs. Min....	nr	"	18 01 17·44		29·03	33·63	4·60		....
	32	B.J. 681.......		"	03 58·86		59·30	03·96	4·66		18 04 03·94
	33	B.J. 684.......		"	12 47·66		48·34	52·99	4·65		12 52·98
	34	446 B. Herc...		"	18 20·54		20·90	.....	....		18 25·54
	35	B.J. 690.......		"	19 48·84		49·18	53·83	4·65		19 53·82
	36	μ Lyrae.......		"	21 12·77		13·40	.....	....		21 18·04
	37	B.J. 694.......		"	22 32·56		33·68	38·46	....		22 38·32
	38	B.J. 699.......	r	"	33 50·42		50·98	55·66	4·68		33 55·62
	39	B.J. 703.......		"	41 44·42		44·73	49·39	4·66		41 49·37
	40	111 Herculis...		"	42 59·96		00·24	.....	....		43 04·88
	41	204 B. Drac...		"	44 39·27		40·17	.....	....		44 44·81
	42	B.J. 705.......		"	46 42·41		42·93	47·57	4·64		46 47·57
	43	B.J. 707.......		"	49 49·30		50·44	55·17	....		49 55·08
	44	B.J. 711.......		"	52 32·68		33·40	38·08	4·68		52 38·04
	45	B.J. 713.......		"	55 31·62		32·13	36·75	4·62		55 36·77
	46	51 H. Cephei..	L.C.,nr	"	58 30·40		17·25	21·95	4·70		....
	47	B.J. 719.......		"	19 04 02·36		02·92	07·58	4·66		19 04 07·56
	48	19 Lyrae.......		"	08 15·85		16·33	.....	....		08 20·97
	49	B.J. 725.......		"	13 32·80		33·00	37·65	4·65		13 37·64

Clamp East. 1—9. Adopted $\Delta T+m=4{\cdot}492+{\cdot}0041(T-16^h\ 30^m)$.
10—49. Adopted $\Delta T+m=4{\cdot}639+{\cdot}0042\ (T-18^h\ 15^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
July 16	1	B.J. 726.......		S	19 14 58·22	·047	59·14	03·89	....	4·64	19 15 03·78
	2	159 B. Lyrae..		"	15 54·47	(·650)	55·12				15 59·76
	3	*b* Aquilae.....		"	20 38·00		38·21				20 42·85
	4	21 B. Vulp....		"	21 39·36		39·74				21 44·38
	5	4 Cygni.......		"	22 51·55		52·11				22 56·75
	6	α Vulp........	r	"	24 54·77		55·10				24 59·74
	7	B.J. 732.......		"	27 02·56		02·98	07·61	4·63		27 07·62
	8	8 Cygni.......		"	28 22·59		23·12				28 27·76
	9	ε Sagittae.....		"	33 10·13		10·39				33 15·03
	10	B.J. 738.......		"	33 58·55		59·36	04·06	....		34 04·00
	11	β Sagittae....		"	36 57·59		57·86				37 02·50
July 19	12	B.J. 614.......		S	16 22 23·13	·040	24·05	29·29	....	5·24	16 22 29·29
	13	*g* Herculis....		"	25 37·15	(·607)	37·79				25 43·03
	14	Groom. 2372..	r	"	30 38·92		42·38				30 47·62
	15	B.D. 72·734...		"	32 46·62		48·62				32 53·86
	16	B.J. 623.......		"	34 26·04		28·86				34 34·10
	17	B.J. 626.......		"	39 44·70		45·28	50·53	5·25		39 50·52
	18	B.D. 79·511...		"	42 55·05		58·24				43 03·48
	19	Groom. 2391..		"	47 01·91		04·73				47 09·97
	20	53 Herculis....		"	49 29·43		29·89				49 35·13
	21	ε Urs. Min.....	rn	"	55 05·93		10·58	15·69	5·11		....
	22	Groom. 2411..		"	57 59·68		01·74				58 06·98
	23	B.D. 75·612...		"	17 03 09·46		11·82				17 03 17·06
	24	Groom. 2427..		"	04 25·73		28·10				04 33·34
	25	B.J. 643.......		"	11 50·91		51·45	56·72	5·27		11 56·69
	26	*e* Herculis....	r	"	14 30·27		30·76				14 36·00
	27	*w* Herculis....		"	17 13·73		14·20				17 19·44
	28	ρ Herculis....		"	20 30·87		31·42				20 36·66
	29	B.J. 650.......	r	"	24 17·19		17·97	23·29	....		24 23·21
	30	Groom. 2456..		"	26 22·22		25·79				26 31·03
	31	B.J. 653.......		"	28 20·12		20·94	26·22	....		28 26·18
	32	B.J. 655.......		"	30 20·38		21·29	26·61	....		30 26·53
	33	Groom. 944...	L.C.,rn	"	32 54·72		47·71	52·88	5·17		....
	34	B.J. 663.......		"	36 51·68		52·34	57·62	....		36 57·58
	35	B.D. 72·800...		"	38 47·33		49·29				38 54·53
	36	B.J. 670.......		"	43 28·60		30·53				43 35·77
	37	*z* Herculis....		"	47 38·30		39·02				47 44·26
	38	168 H. Herc...		"	49 05·26		05·86				49 11·10
	39	B.J. 675.......		"	53 25·18		27·85				53 33·09
	40	B.D. 78·616...		"	55 11·24		14·22				55 19·46
	41	ψ^2 Draconis...		"	56 41·09		43·00			5.25	56 48·25
	42	δ Urs. Min....	rn	"	18 01 16·52		27·27	32·87	5·60		....
	43	40 Draconis...		"	06 43·74		47·22				18 06 52·47
	44	B.J. 684.......		"	12 47·15		47·79	52·98	5·19		12 53·04
	45	B.J. 693.......		"	21 59·59		01·42				22 06·67
	46	B.J. 700.......		"	34 02·89		05·67				34 10·92
	47	Bradley 2382..		"	44 08·19		09·96				44 15·21
	48	B.J. 705.......		"	46 41·83		42·31	47·58	5·27		46 47·56
	49	Groom. 2719..		"	47 58·25		00·40				48 05·65

Clamp East. 1—11. Adopted $\Delta T+m=4·639+·0042$ (T−18^h 15^m).
12—49. Adopted $\Delta T+m=5·246+·0042$ (T−18^h 10^m).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
July 19	1	50 Draconis		S	18 49 13·63	·040	15·99			5·25	18 49 21·24
	2	B.D. 79·604		"	51 57·05	(·607)	00·48				52 05·73
	3	51 H. Cephei	L.C.,rn	"	58 29·42		17·29	22·61	5·32		....
	4	B.J. 719		"	19 04 01·79		02·31	07·59	5·28		19 04 07·56
	5	B.D. 70·1073		"	31 40·20		41·98				31 47·23
	6	B.D. 49·3059		"	33 27·57		28·32				33 33·57
	7	B.J. 738		"	33 58·02		58·77	04·07			34 04·02
	8	14 Cygni		"	36 27·01		27·66				36 32 91
	9	B.J. 740		"	40 58·21		58·76	04·04	5·28		41 04·01
	10	B.J. 742	r	"	42 06·10		06·74	12·03	5·29		42 11·99
	11	B.J. 747		"	48 25·36		27·07				48 32·32
	12	B.J. 750		"	53 14·54		15·35	20·63			53 20·60
	13	B.D. 69·1084		"	58 51·68		53·39				58 58·64
July 26	14	B.J. 627		S	16 43 30·52	−·046	31·30	37·40		6·04	16 43 37·34
	15	B.J. 629		"	47 54·51	(·582)	54·66	00·74	6·08		48 00·70
	16	53 Herculis		"	49 28·64		28·98				49 35·02
	17	ε Urs. Min	nr	"	55 04·80		08·83	14·78	5·95		....
	18	*d* Herculis		"	58 12·41		12·78				58 18·82
	19	B.J. 635	r	"	17 01 07·94		08·02	14·08	6·06		17 01 14·06
	20	B.J. 636		"	04 45·93		46·41	52·48	6·07		04 52·45
	21	B.J. 640		"	10 28·24		28·38	34·45	6·07		10 34·42
	22	B.J. 643		"	11 50·12		50·54	56·63	6·09		11 56·58
	23	*u* Herculis		"	13 55·49		55·85				14 01·89
	24	*w* Herculis		"	17 12·97		13·32				17 19·36
	25	ρ Herculis		"	20 30·09		30·51				20 36·55
	26	B.J. 650		"	24 16·55		17·10	23·17			24 23·14
	27	λ Herculis		"	27 01·63		01·90				27 07·94
	28	B.J. 653		"	28 19·31		19·97	26·09			28 26·01
	29	B.J. 656		"	30 41·16		41·28	47·30	6·02		30 47·32
	30	Groom. 944	L.C.,nr	"	32 54·39		48·28	54·38	6·10		....
	31	B.J. 663		"	36 50·95		51·46	57·52			36 57·50
	32	B.J. 667		"	42 51·76		52·06	58·08	6·02		42 58·10
	33	87 Herculis	r	"	45 05·87		06·09				45 12·13
	34	*z* Herculis		"	47 37·58		38·14				47 44·18
	35	168 H. Herc		"	49 04·45		04·92				49 10·96
	36	89 Herculis		"	51 43·00		43·27				51 49·31
	37	B.J. 672		"	53 05·56		05·98	12·01	6·03		53 12·02
	38	B.J. 676		"	54 26·44		27·07	33·20			54 33·11
	39	δ Urs. Min	nr	"	18 01 15·37		24·76	31·12	6·36		....
	40	B.J. 681		"	03 57·57		57·88	03·92	6·04		18 04 03·92
	41	B.J. 684		"	12 46·38		46·88	52·93	6·05		12 52·92
	42	446 B. Herc		"	18 19·27		19·51				18 25·55
	43	B.J. 690		"	19 47·56		47·78	53·82	6·04		19 53·82
	44	μ Lyrae	r	"	21 11·58		11·98				21 18·02
	45	B.J. 694		"	22 31·44		32·28	38·31			22 38·32
	46	B.J. 699		"	33 49·12		49·57	55·62	6·05		33 55·61
	47	B.J. 703		"	41 43·13		43·34	49·39	6·05		41 49·38
	48	111 Herculis		"	42 58·68		58·86				43 04·90
	49	204 B. Drac		"	44 38·08		38·74				44 44·78

From July 19 Clamp East; from July 26 Clamp West.
1—13. Adopted $\Delta T+m=5\cdot246+\cdot0042\ (T-18^{h}\ 10^{m})$.
14—49. Adopted $\Delta T+m=6\cdot044+\cdot0043\ (T-18^{h}\ 35^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
July 26	1	B.J. 705		S	18 46 41·13	− ·046	41·49	47·56	6·07	6·04	18 46 47·53
	2	B.J. 707		"	49 48·19	(·582)	49·05	55·07		6·05	49 55·10
	3	B.J. 711		"	52 31·44		31·97	38·04	6·07		52 38·02
	4	B.J. 713		"	55 30·40		30·75	36·75	6·00		55 36·80
	5	51 H. Cephei	L.C.,nr	"	58 28·87		18·33	24·33	6·00		
	6	B.J. 719		"	19 04 01·11		01·51	07·58	6·07		19 04 07·56
	7	19 Lyrae		"	08 14·69		15·02				08 21·07
	8	B.J. 725		"	13 31·52		31·63	37·69	6·06		13 37·68
	9	B.J. 726		"	14 57·12		57·79	03·85			15 03·84
	10	159 B. Lyrae		"	15 53·24		53·71				15 59·76
	11	*b* Aquilae		"	20 36·75		36·86				20 42·91
	12	21 B.Vulp	r	"	21 38·21		38·42				21 44·47
	13	4 Cygni		"	22 50·38		50·78				22 56·83
	14	α Vulp		"	24 53·46		53·72				24 59·77
	15	ϕ Aquilae		"	51 54·57		54·68				52 00·73
	16	B.J. 752		"	54 41·25		41·44	47·44	6·00		54 47·49
	17	15 Vulp		"	57 19·48		19·77				57 25·82
	18	b^2 Cygni		"	20 06 00·78		01·19				20 06 07·24
	19	20 Vulp		"	08 10·11		10·38				08 16·43
	20	30 Cygni		"	10 24·01		24·54				10 30·59
	21	B.J. 760		"	12 51·91		52·16	58·19	6·03		12 58·21
	22	176 B. Cygni		"	16 55·21		55·66				17 01·71
	23	B.J. 765		"	18 55·53		56·00	02·11	6·11		19 02·05
	24	40 Cygni	r	"	24 09·97		10·35				24 16·40
	25	41 Cygni		"	25 38·88		39·20				25 45·25
July 28	26	40 Draconis		N	18 06 42·88	− ·060	45·92			6·12	18 06 52·04
	27	B.J. 684		"	12 46·29	(·580)	46.75	52·91	6·16		12 52·87
	28	446 B. Herc		"	18 19·16		19·36				18 25·48
	29	B.J. 690		"	19 47·52		47·70	53·81	6·11		19 53·82
	30	B.J. 694		"	22 31·41		32·27	38·28			22 38·39
	31	B.J. 699		"	33 49·11		49·50	55·61	6·11		33 55·62
	32	111 Herculis		"	42 58·59		58·73			6·13	43 04·86
	33	204 B. Drac		"	44 37·99		38·67				44 44·80
	34	B.J. 705		"	46 41·05		41·37	47·55	6·18		46 47·50
	35	B.J. 707		"	49 47·96		48·84	55·04			49 54·97
	36	B.J. 711		"	52 31·41		31·89	38·03	6·14		52 38·02
	37	B.J. 713		"	55 30·27		30·58	36·75	6·17		55 36·71
	38	51 H. Cephei	L.C.	"	58 29·04		18·80	24·77	5·97		
	39	B.J. 719		"	19 04 01·03		01·38	07·58	6·20		19 04 07·51
	40	λ Urs. Min		"	11 07·28		38·51	44·26	5·75		
	41	B.J. 726		"	14 56·98		57·67	03·84			15 03·80
	42	21 B. Vulp		"	21 38·13		38·35				21 44·48
	43	4 Cygni		"	22 50·37		50·72				22 56·85
	44	α Vulp	r	"	24 53·45		53·67				24 59·80
	45	B.J. 732		"	27 01·38		01·63	07·66	6·03		27 07·76
	46	8 Cygni		"	28 21·40		21·73				28 27·86
	47	B.D. 49·3059		"	33 26·90		27·50				33 33·63
	48	B.J. 738		"	33 57·26		57·86	04·06			34 03·99
	49	14 Cygni		"	36 26·38		26·84				36 32·97
	50	10 Vulp		"	39 54·15		54·38				40 00·51

Clamp West. 1—25. Adopted $\Delta T+m=6{\cdot}044+{\cdot}0043\ (T-18^h\ 35^m)$.
26—50. Adopted $\Delta T+m=6{\cdot}128+{\cdot}0044\ (T-19^h\ 15^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
July 28	1	B.J. 740.......		N	19 40 57·51	— ·060	57·88	04·07	6·19	6·13	19 41 04·01
	2	B.J. 742.......		"	42 05·33	(·580)	05·83	12·04	6·21		42 11·96
	3	ζ Sagittae.....		"	44 54·93		55·08	....	....		45 01·21
	4	φ Aquilae.....		"	51 54·46		54·54	....	....		52 00·67
	5	B.J. 750.......		"	53 13·80		14·46	20·64	....		53 20·59
	6	B.J. 752.......		"	54 41·22		41·37	47·46	6·09		54 47·50
	7	15 Vulp.... ..		"	57 19·44		19·68	....	....		57 25·81
	8	Groom. 1119..	L.C.	"	20 08 20·89		54·61	00·86	6·25		....
	9	B.J. 760.......		"	12 51·89		52·11	58·20	6·09		20 12 58·24
July 30	10	B.J. 703.......		N	18 41 42·87	— ·034	43·07	49·38	6·31	6·37	18 41 49·44
	11	111 Herculis...		"	42 58·39	(·601)	58·57	.....	......		43 04·94
	12	204 B. Drac...		"	44 37·71		38·45	....	....		44 44·82
	13	B.J. 707.......		"	49 47·72		48·68	55·01	......		49 55·05
	14	B.J. 711.......		"	52 31·03		31·57	38·02	6·45		52 37·94
	15	B.J. 713.......		"	55 30·03		30·38	36·74	6·36		55 36·75
	16	51 H. Cephei..	L.C.,nr	"	58 28·78		17·60	25·30	7·70		....
	17	B.J. 719.......		"	19 04 00·82		01·23	07·58	6·35		19 04 07·60
	18	b Aquilae		"	20 36·41		36·52	.....	....		20 42·89
	19	21 B. Vulp....		"	21 37·82		38·08	.....	....		21 44·45
	20	4 Cygni.......		"	22 50·08		50·49	.....	....		22 56·86
	21	α Vulp.		"	24 53·19		53·45	....	......		24 59·82
	22	B.J. 732.......		"	27 01·01		01·30	07·66	6·36		27 07·67
	23	8 Cygni.......		"	28 21·09		21·47	.....	....		28 27·84
	24	B.D. 49·3059..		"	33 26·53		27·19	.....	....		33 33·56
	25	B.J. 738.......		"	33 57·08		57·74	04·05	....		34 04·11
	26	β Sagittae.....		"	36 56·03		56·20	.....	....		37 02·57
	27	10 Vulp.......		"	39 53·94		54·20	.....	....		40 00·57
	28	B.J. 740.......		"	40 57·28		57·71	04·06	6·35		41 04·08
	29	B.J. 742.......		"	42 05·13		05·69	12·03	6·34		42 12·06
	30	B.J. 743.......		"	43 18·11		18·29	24·67	6·38		43 24·66
	31	ζ Sagittae.....		"	44 54·58		54·76	.....	....		45 01·13
	32	φ Aquilae.....		"	51 54·27		54·37	.....	....		52 00·74
	33	B.J. 750.......		"	53 13·52		14·24	20·63	....		53 20·61
	34	B.J. 752.......		"	54 40·90		41·09	47·46	6·37		54 47·46
	35	15 Vulp.......		"	57 19·16		19·44	.....	....		57 25·81
	36	Groom. 1119..	L.C.	"	20 08 24·14		55·44	01·44	6·00		....
	37	B.J. 760.......		"	12 51·56		51·82	58·21	6·39		20 12 58·19
	38	176 B. Cygni..		"	16 54·94		55·39	.....	....		17 01·76
	39	B.J. 765.......		"	18 55·27		55·73	02·13	6·40		19 02·10
	40	40 Cygni......		"	24 09·65		10·08	.....	....		24 16·45
	41	41 Cygni......		"	25 38·54		38·86	.....	....		25 45·23
	42	B.J. 768.......		"	28 50·57		50·66	57·03	6·37		28 57·03
	43	ζ Delphini.....		"	31 01·71		01·85	.....	....		31 08·22
	44	B.J. 771.......		"	33 15·40		15·53	21·94	6·41		33 21·90
	45	29 Vulp.......		"	34 25·72		25·93	.....	....		34 32·30
	46	B.J. 774.......		"	35 23·13		23·28	29·68	6·40		35 29·65
	47	B.J. 777.......		"	38 17·15		17·71	24·10	6·39		38 24·08
	48	B.J. 778.......		"	39 11·16		11·30	17·64	6·34		39 17·67
	49	B.J. 780.......		"	42 29·55		29·92	36·38	6·46	6·38	42 36·30

Clamp West. 1— 9. Adopted $\Delta T+m=6{\cdot}128+{\cdot}0044$ (T-19^{h} 15^{m}).
10—49. Adopted $\Delta T+m=6{\cdot}371+{\cdot}0044$ (T-19^{h} 45^{m}).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
July 30	1	B.J. 784.......		N	20 43 49·56	—·034	49·97	56·36	6·39	6·38	20 43 56·35
	2	76 Draconis...		"	49 05·57	(·601)	09·83	16·27	6·44		....
	3	220 H[1] Drac...		"	51 37·60		40·97	47·56	6·59		....
Aug. 2	4	B.J. 684.......		S	18 12 45·71	—·040	46·28	52·85	6·57	6·57	18 12 52·85
	5	446 B. Herc...		"	18 18·62	(·639)	18·89	.....	....		18 25·46
	6	B.J. 690.......	r	"	19 47·02		47·23	53·79	6·56		19 53·80
	7	μ Lyrae......		"	21 10·93		11·44	.....	....		21 18·01
	8	B.J. 699.......	r	"	33 48·55		48·99	55·57	6·58		33 55·56
	9	B.J. 703.......		"	41 42·56		42·80	49·37	6·57		41 49·37
	10	111 Herculis...		"	42 58·10		58·31	.....	....		43 04·88
	11	204 B. Drac...		"	44 37·39		38·13	.....	....		44 44·70
	12	B.J. 705.......		"	46 40·54		40·95	47·52	6·57		46 47·52
	13	B.J. 707.......		"	49 47·48		48·44	54·95	....		49 55·01
	14	B.J. 711.......		"	52 30·79		31·38	37·99	6·61	6·58	52 37·96
	15	51 H. Cephei..	L.C.,rn	"	58 31·44		19·59	26·27	6·68		....
	16	B.J. 719.......		"	19 04 00·47		00·93	07·56	6·63		19 04 07·51
	17	λ Urs. Min....		"	10 57·73		33·54	40·39	6·85		....
	18	*b* Aquilae.....		"	20 36·12		36·25	.....	....		20 42·83
	19	21 B. Vulp....		"	21 37·51		37·79	.....	....		21 44·37
	20	4 Cygni.......		"	22 49·75		50·21	.....	....		22 56·79
	21	α Vulp........	r	"	24 53·00		53·23	.....	....		24 59·81
	22	B.J. 733.......		"	27 21·34		22·06	28·61	....		27 28·64
	23	8 Cygni.......		"	28 20·76		21·18	.....	....		28 27·76
	24	ϵ Sagittae.....		"	33 08·36		08·55	.....	....		33 15·13
	25	B.J. 738.......		"	33 56·83		57·50	04·03	....		34 04·08
	26	β Sagittae.....		"	36 55·87		56·07	.....	....		37 02·65
	27	10 Vulp.......		"	39 53·67		53·97	.....	....		40 00·55
	28	B.J. 740.......		"	40 56·98		57·46	04·06	6·60		41 04·04
	29	B.J. 742.......		"	42 04·78		05·40	12·02	6·62		42 11·98
	30	B.J. 743.......		"	43 17·90		18·11	24·67	6·56		43 24·69
	31	ζ Sagittae.....	r	"	44 54·45		54·62	.....	....		45 01·20
	32	ϕ Aquilae.....		"	51 54·03		54·16	.....	....		52 00·74
	33	B.J. 752.......		"	54 40·65		40·87	47·47	6·60		54 47·45
	34	15 Vulp.......		"	57 18·91		19·23	.....	....		57 25·81
Aug. 7	35	B. J. 650.......	r	S	17 24 15·11	—·040	15·79	22·94	....	7·14	17 24 22·93
	36	Groom. 2456..		"	26 18·54	(·621)	21·86	.....	....		26 29·00
	37	B.J. 653.......		"	28 17·87		18·58	25·83	....		28 25·72
	38	B.J. 655.......		"	30 18·16		18·95	26·18	....		30 26·09
	39	Groom. 944...	L.C.,rn	"	32 57·15		50·50	57·38	6·88		....
	40	B.J. 663.......		"	36 49·54		50·11	57·31	....		36 57·25
	41	B.D. 72·800...	r	"	38 44·39		46·34	.....	....		38 53·48
	42	B.J. 670.......		"	43 25·95		27·71	.....	....		43 34·85
	43	*z* Herculis.. ..		"	47 36·19		36·80	.....	....		47 43·94
	44	168 H. Herc...		"	49 03·19		03·70	.....	....		49 10·84
	45	B.J. 675.......		"	53 22·36		24·84	.....	....		53 31·98
	46	B.D. 78·616...		"	55 08·28		11·05	.....	....		55 18·19
	47	ψ^2 Draconis...		"	56 38·45		40·19	.....	....		56 47·33
	48	δ Urs. Min....	rn	"	18 01 09·97		20·13	27·42	7·29		....

Clamp West. 1—3. Adopted $\Delta T+m=6\cdot371+\cdot0044\ (T-19^h\ 45^m)$.
4—34. Adopted $\Delta T+m=6\cdot576+\cdot0044\ (T-19^h\ 05^m)$.
35—48. Adopted $\Delta T+m=7\cdot144+\cdot0045\ (T-19^h\ 15^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Aug. 7	1	40 Draconis...		S	18 06 40·62	−·040	43·87	.....	.....	7·14	18 06 51·01
	2	B.J. 684.......		"	12 45·09	(·621)	45·64	52·79	7·15		12 52·78
	3	B.J. 695.......		"	22 34·92		36·74	.....	.....		22 43·88
	4	B.J. 700.......		"	34 00·12		02·69	.....	.....		34 09·83
	5	Bradley 2382..		"	44 05·87		07·49	.....	.....		44 14·63
	6	Groom. 2719..		"	47 55·86		57·84	.....	.....		48 04·98
	7	50 Draconis...		"	49 11·08		13·26	.....	.....		49 20·40
	8	B.D. 79·604...		"	51 54·11		57·31	.....	.....		52 04·45
	9	51 H. Cephei..	L.C.,rn	"	58 32·00		20·52	27·99	7·47		....
	10	B.J. 719.......		"	19 03 59·88		00·32	07·53	7·21		19 04 07·46
	11	λ Urs. Min....	rn	"	10 55·09		29·85	36·11	6·26		....
	12	B.J. 729.......		"	17 11·78		13·67	.....	.....		17 20·81
	13	4 Cygni.......		"	22 49·19		49·63	.....	.....		22 56·77
	14	B.D. 76·734...		"	24 40·77		43·13	.....	.....		24 50·27
	15	B.J. 734.......		"	27 03·73		06·79	.....	.....		27 13·93
	16	B.D. 70·1073..		"	31 38·17		39·79	.....	.....	7·15	31 46·94
	17	B.J. 738.......		"	33 56·26		56·91	04·00	.....		34 04·06
	18	14 Cygni......		"	36 25·24		25·80	.....	.....		36 32·95
	19	B.J. 740.......		"	40 56·44		56·90	04·04	7·14		41 04·05
	20	B.J. 742.......		"	42 04·23		04·83	12·00	7·17		42 11·98
	21	B.J. 747.......		"	48 23·30		24·86	.....	.....		48 32·01
	22	B.D. 69·1084..		"	58 49·82		51·38	.....	.....		58 58·53
	23	b^2 Cygni......		"	20 05 59·65		00·10	.....	.....		20 06 07·25
	24	B.J. 759.......		"	11 50·72		53·29	.....	.....		12 00·44
	25	176 B.Cygni...		"	16 54·09		54·58	.....	.....		17 01·73
	26	B.J. 765.......		"	18 54·49		55·00	02·14	7·14		19 02·15
	27	40 Cygni......	r	"	24 08·91		09·33	.....	.....		24 16·48
	28	41 Cygni......		"	25 37·75		38·10	.....	.....		25 45·25
	29	ω^1 Cygni......		"	27 10·83		11·45	.....	.....		27 18·60
	30	Groom. 3241..		"	30 18·90		20·67	.....	.....		30 27·82
	31	B.J. 770.......		"	32 37·07		39·14	.....	.....		32 46·29
Aug. 8	32	87 Herculis...		N	17 45 04·53	−·043	04·79	.....	.....	7·20	17 45 11·99
	33	z Herculis....		"	47 36·18	(·619)	36·82	.....	.....		47 44·02
	34	168 H. Herc...		"	49 03·18		03·65	.....	.....		49 10·85
	35	89 Herculis....		"	51 41·65		41·91	.....	.....		51 49·11
	36	B.D. 78·616...		"	55 08·26		11·12	.....	.....		55 18·32
	37	ψ^2 Draconis...		"	56 38·40		40·21	.....	.....		56 47·41
	38	δ Urs. Min....	nr	"	18 01 09·58		19·66	27·14	7·48		....
	39	40 Draconis...		"	06 40·15		43·50	.....	.....		18 06 50·70
	40	B.J. 684.......		"	12 45·03		45·54	52·77	7·23		12 52·74
	41	446 B. Herc...		"	18 17·98		18·22	.....	.....		18 25·42
	42	B.J. 690.......		"	19 46·30		46·52	53·75	7·23		19 53·72
	43	μ Lyrae......		"	21 10·18		10·64	.....	.....		21 17·84
	44	B.J. 694.......		"	22 29·80		30·75	.....	.....		22 37·95
	45	B.J. 700.......		"	34 00·13		02·79	.....	.....		34 09·99
	46	B.J. 703.......		"	41 41·90		42·10	49·34	7·24		41 49·30
	47	Bradley 2382..		"	44 05·69		07·36	.....	.....		44 14·56
	48	B.J. 705.......		"	46 39·89		40·26	47·48	7·22		46 47·46
	49	Groom. 2719..		"	47 55·70		57·74	.....	.....		48 04·94

Clamp West. 1—31. Adopted $\Delta T+m=7{\cdot}144+{\cdot}0045$ ($T-19^h\ 15^m$).
32—49. Adopted $\Delta T+m=7{\cdot}206+{\cdot}0045$ ($T-19^h\ 05^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Aug. 8	1	50 Draconis...		N	18 49 11·09	—·043	13·35	.....	....	7·20	18 49 20·55
	2	B.D. 79·604...		"	51 54·21	(·619)	57·52	.....	....	7·21	52 04·73
	3	B.J. 714.......		"	55 24·33		26·04	.....	....		55 33·25
	4	51 H. Cephei..	L.C.,nr	"	58 31·74		20·37	28·30	7·93		....
	5	B.J. 719.......		"	19 03 59·87		00·28	07·52	7·24		19 04 07·49
	6	λ Urs. Min....		"	10 52·74		27·22	35·38	8·16		....
	7	B.J. 726.......		"	14 55·75		56·52	03·73	....		15 03·73
	8	B.J. 729.......		"	17 11·64		13·59	.....	....		17 20·80
	9	21 B. Vulp....		"	21 36·91		37·16	.....	....		21 44·37
	10	4 Cygni.......		"	22 49·12		49·53	.....	....		22 56·74
	11	B.D. 76·734...		"	24 40·50		42·94	.....	....		24 50·15
	12	B.J. 734.....		"	27 03·44		06·60	.....	....		27 13·81
	13	8 Cygni.......		"	28 20·15		20·53	.....	....		28 27·77
	14	B.D. 70·1073..		"	31 37·94		39·62	.....	....		31 46·84
	15	B.D. 49·3059..		"	33 25·69		26·36	.....	....		33 33·53
	16	B.J. 738.......		"	33 56·14		56·81	03·99	....		34 04·02
	17	14 Cygni......		"	36 25·23		25·75	.....	....		36 32·96
	18	10 Vulp.......		"	39 53·02		53·28	.....	....		40 00·49
	19	B.J. 742.......		"	42 04·26		04·83	12·00	7·17		42 12·04
	20	B.J. 747.......		"	48 23·47		25·08	.....	....		48 32·29
	21	φ Aquilae.....		"	51 53·52		53·61	.....	....		52 00·82
	22	B.J. 750.......		"	53 12·61		13·35	20·58	....		53 20·56
	23	B.J. 752.......		"	54 40·10		40·29	47·48	7·19		54 47·50
	24	15 Vulp.......		"	57 18·25		18·53	.....	....		57 25·74
Aug. 11	25	B.J. 700.......		S	18 33 59·23	—·041	01·91	.....	....	7·73	18 34 09·64
	26	Bradley 2382..		"	44 05·12	(·646)	06·81	.....	....		44 14·54
	27	B.J. 705.......		"	46 39·25		39·67	47·44	7·77		46 47·40
	28	Groom. 2719..		"	47 54·92		56·99	.....	....		48 04·72
	29	50 Draconis...		"	49 10·32		12·59	.....	....		49 20·32
	30	51 H. Cephei..	L.C.,nr	"	58 32·87		20·90	29·18	8·28		....
	31	B.J. 719.......		"	19 03 59·26		59·72	07·49	7·77		19 04 07·45
	32	λ Urs. Min....	nr	"	10 50·16		26·33	33·13	6·80		....
	33	B.J. 729.......		"	17 10·96		12·92	.....	....		17 20·65
	34	4 Cygni.......		"	22 48·56		49·02	.....	....		22 56·75
	35	B.D. 76·734...		"	24 39·82		42·28	.....	....		24 50·01
	36	B.J. 734.......		"	27 02·87		06·07	.....	....		27 13·80
	37	B.D. 70·1073..		"	31 37·53		39·23	.....	....		31 46·96
	38	B.D. 49·3059..		"	33 25·20		25·88	.....	....		33 33·61
	39	B.J. 738.......	r	"	33 55·50		56·25	03·95	....		34 03·98
	40	14 Cygni......	r	"	36 24·71		25·22	.....	....		36 32·95
	41	B.J. 740.......		"	40 55·79		56·27	04·01	7·74		41 04·00
	42	B.J. 742.......		"	42 03·59		04·22	11·97	7·75	7·74	42 11·96
	43	B.D. 69·1084..		"	58 49·16		50·78	.....	....		58 58·52
	44	69 Draconis...		"	20 02 02·58		05·01	.....	....		20 02 12·75
	45	Groom. 1119..	L.C.,nr	"	08 30·02		59·33	07·46	8·13		....
	46	176 B. Cygni..		"	16 53·45		53·95	.....	....		17 01·69
	47	B.J. 765.......	r	"	18 53·93		54·39	02·13	7·74		19 02·13
	48	40 Cygni......		"	24 08·18		08·67	.....	....		24 16·45
	49	41 Cygni......		"	25 37·15		37·51	.....	....		25 45·21

Clamp West. 1—24. Adopted $\Delta T+m=7{\cdot}206+{\cdot}0045\ (T-19^h\ 05^m)$.
25—49. Adopted $\Delta T+m=7{\cdot}737+{\cdot}0065\ (T-20^h\ 00^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
1910											
Aug. 11	1	ω^1 Cygni......		S	20 27 10·24	−·041	10·89	.....	....	7·74	20 27 18·63
	2	Groom. 3241 ..		"	30 18·14	(·646)	19·99	.....	......		30 27·73
	3	B.J. 770.......		"	32 36·19		38·35	.....	.....		32 46·09
	4	76 Draconis...	nr	"	49 03·47		08·01	15·91	7·90		....
	5	220 H[1]. Drac..		"	51 35·98		39·45	47·32	7·87		....
	6	B.J. 788.......		"	53 43·05		43·59	51·33	7·74		53 51·33
	7	Bradley 2748..		"	55 42·63		44·94	.....	....		55 52·68
	8	B.J. 792......		"	21 01 33·35		33·94	41·74	7·80		21 01 41·68
	9	B.J. 793.......		"	02 45·98		46·47	54·21	7·74		02 54·21
	10	Groom. 3409..		"	05 45·24		46·97	.....	......		05 54·71
	11	B.J. 798......		"	09 24·73		25·73	33·44	....		09 33·47
	12	B.J. 799.....		"	11 05·93		06·42	14·15	7·73		11 14·16
	13	σ Cygni.......		"	13 46·79		47·29	....	....		13 55·03
	14	Bradley 2796..		"	16 35·91		38·41	.....	....	7·75	16 46·16
Aug. 12	15	Groom. 2411..		N	16 57 55·80	−·042	57·80	...	....	7·84	16 58 05·64
	16	B.J. 635.......		"	17 01 05·93	(·630)	06·05	13·90	7·85		17 01 13·89
	17	B.D. 75·612..		"	03 05·57		07·87	.....	....		03 15·71
	18	Groom. 2427..		"	04 21·61		23·92	....	....		04 31·76
	19	B.J. 640.......		"	10 26·28		26·41	34·27	7·86		10 34·25
	20	B.J. 643.......		"	11 48·06		48·49	56·36	7·87		11 56·33
	21	e Herculis		"	14 27·40		27·84	.....	....		14 35·68
	22	w Herculis....		"	17 10·94		11·30	.....	....		17 19·14
	23	ρ Herculis		"	20 28·05		28·49	....	....		20 36·33
	24	B.J. 650.......		"	24 14·33		14·98	22·82	... ...		24 22·82
	25	Groom. 2456..		"	26 17·31		20·80	.....	......		26 28·64
	26	B.J. 653......		"	28 17·05		17·81	25·70	......		28 25·65
	27	B.J. 655.......		"	30 17·20		18·05	26·03	....		30 25·89
	28	Groom. 944 ..	L.C.,nr	"	32 57·43		50·70	58·62	7·92		....
	29	B.J. 663.....		"	36 48·74		49·34	57·21	......		36 57·18
	30	B.D. 72·800...		"	38 43·58		45·48	....	......		38 53·32
	31	B.J. 670.......		"	43 24·88		26·74	...	... ...		43 34·58
	32	87 Herculis....		"	45 03·84		04·11	...	... ...		45 11·95
	33	z Herculis		"	47 35·36		36·01	....	....		47 43·85
	34	168 H. Herc. ..		"	49 02·49		02·97	.....	.....		49 10·81
	35	89 Herculis....		"	51 40·98		41·26	....	... ..		51 49·10
	36	B.J. 675.......		"	53 20·93		23·54	....	....		53 31·38
	37	B.D. 78·616...		"	55 07·06		09·98	.....	......		55 17·82
	38	δ Urs. Min....	nr	"	18 01 07·58		17·86	25·90	8·04		....
	39	40 Draconis...		"	06 39·13		42·55	....	....	7·85	18 06 50·40
	40	B.J. 684.......		"	12 44·33		44·85	52·70	7·85		12 52·70
	41	446 B. Herc...		"	18 17·36		17·60	.....	....		18 25·45
	42	B.J. 690.......		"	19 45·61		45·83	53·70	7·87		19 53·68
	43	B.J. 695.......		"	22 33·84		35·76	.....	....		22 43·61
	44	B.J. 699.......		"	33 47·16		47·61	55·45	7·84		33 55·46
	45	B.J. 703.......		"	41 41·29		41·49	49·31	7·82		41 49·34
	46	111 Herculis...		"	42 56·77		56·95	....	....		43 04·80
	47	Bradley 2382..		"	44 04·93		06·64	....	....		44 14·49
	48	B.J. 705.......		"	46 39·26		39·64	47·43	7·79		46 47·49
	49	Groom. 2719..		"	47 54·58		56·67	.....	....		48 04·52

Clamp West. 1—14. Adopted $\Delta T+m=7·737+·0065$ $(T-20^h\ 00^m)$.
15—49. Adopted $\Delta T+m=7·848+·0069$ $(T-18^h\ 30^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Aug. 12	1	B.D. 79·604...		N	18 51 53·03	−·042	56·39	.....	....	7·85	18 52 04·24
	2	B.J. 714.......		"	55 23·22	(·630)	24·98	.....	....		55 32·83
	3	51 H. Cephei..	L.C.,nr	"	58 32·56		20·95	29·51	8·56		....
	4	B.J. 719......		"	19 03 59·18		59·60	07·48	7·88		19 04 07·45
	5	λ Urs. Min....		"	10 46·90		22·05	32·28	10·23		....
	6	B.J. 726.......		"	14 54·95		55·73	03·65	....		15 03·58
	7	B.J. 729.......		"	17 10·74		12·72	.....	....		17 20·57
	8	*b* Aquilae		"	20 34·95		35·06	.....	....		20 42·91
	9	21 B. Vulp....		"	21 36·28		36·54	.....	....		21 44·39
	10	4 Cygni.......		"	22 48·47		48·89	.....	....		22 56·74
	11	B.D. 76·734...		"	24 39·58		42·06	.....	....		24 49·91
	12	B.J. 734.......		"	27 02·54		05·77	.....	....		27 13·62
	13	8 Cygni.......		"	28 19·32		19·71	.....	....		28 27·56
	14	B.D. 70·1073..		"	31 37·06		38·78	.....	....	7·86	31 46·64
	15	B.D. 49·3059..		"	33 24·90		25·59	.....	....		33 33·45
	16	B.J. 738.......		"	33 55·40		56·09	03·93	....		34 03·95
	17	14 Cygni......		"	36 24·50		25·03	.....	....		36 32·89
	18	10 Vulp.......		"	39 52·35		52·62	.....	....		40 00·48
	19	B.J. 740.......		"	40 55·65		56·09	04·01	7·92		41 03·95
	20	B.J. 742.......		"	42 03·45		04·03	11·96	7·93		42 11·89
	21	B.J. 743.......		"	43 16·60		16·78	24·66	7·88		43 24·64
	22	ζ Sagittae.....		"	44 53·07		53·25	.....	....		45 01·11
	23	B.J. 747.......		"	48 22·43		24·07	.....	....		48 31·93
	24	φ Aquilae		"	51 52·79		52·90	.....	....		52 00·76
	25	B.J. 750.......		"	53 11·86		12·61	20·53	....		53 20·47
	26	B.J. 752.......		"	54 39·48		39·67	47·47	7·80		54 47·53
	27	15 Vulp.......		"	57 17·64		17·93	.....	....		57 25·79
	28	B.D. 69·1084..		"	58 48·94		50·59	.....	....		58 58·45
	29	Groom. 1119..	L.C.,nr	"	20 08 28·98		59·21	07·95	8·74		....
Aug. 19	30	B.J. 643.......		N	17 11 46·45	·035	47·02	56·23	9·21	9·19	17 11 56·21
	31	*e* Herculis		"	14 25·76	(·694)	26·34	.....	....		14 35·53
	32	*w* Herculis		"	17 09·31		09·80	.....	....		17 18·99
	33	ρ Herculis	r	"	20 26·43		27·01	.....	....		20 36·20
	34	B.J. 650.......		"	24 12·63		13·47	22·65	....		24 22·66
	35	Groom. 2456..		"	26 14·42		18·60	.....	....		26 27·79
	36	B.J. 653.......		"	28 15·37		16·33	25·50	....		28 25·52
	37	B.J. 657.......		"	30 20·85		21·92	31·22	....		30 31·11
	38	Groom. 944...	L.C.,nr	"	32 59·13		51·15	00·68	9·53		....
	39	B.J. 663.......		"	36 47·07		47·85	57·05	....		36 57·04
	40	B.D. 72·800...		"	38 41·58		43·88	.....	....		38 53·07
	41	B.J. 670.......		"	43 22·62		24·88	.....	....		43 34·07
	42	87 Herculis....		"	45 02·32		02·69	.....	....		45 11·88
	43	*z* Herculis		"	47 33·59		34·44	.....	....		47 43·63
	44	168 H. Herc...		"	49 00·84		01·47	.....	....		49 10·66
	45	89 Herculis....		"	51 39·42		39·80	.....	....		51 48·99
	46	B.J. 675.......		"	53 18·56		21·69	.....	....		53 30·88
	47	B.D. 78·616...		"	55 04·24		07·73	.....	....		55 16·92
	48	ψ^2 Draconis...		"	56 35·15		37·39	.....	....		56 46·58
	49	δ Urs. Min....	nr	"	18 01 02·02		14·18	23·25	9·07		....

From Aug 12 Clamp West; from Aug. 19 Clamp East.

1—29. Adopted $\Delta T+m=7{\cdot}848+{\cdot}0069\ (T-18^h\ 30^m)$.

30—49. Adopted $\Delta T+m=9{\cdot}204+{\cdot}0094\ (T-19^h\ 00^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Aug. 19	1	B.J. 681.......		N	18 03 54·03	·035	54·45	03·66	9·21	9·20	18 04 03·65
	2	40 Draconis...		"	06 36·51	(·694)	40·61	.....	....		06 49·81
	3	B.J. 684.......		"	12 42·61		43·29	52·57	9·28		12 52·49
	4	446 B. Herc...		"	18 15·77		16·11	.....	....		18 25·31
	5	B.J. 690.......		"	19 44·11		44·43	53·62	9·19		19 53·63
	6	μ Lyrae.......		"	21 07·92		08·54	.....	....		21 17·74
	7	B.J. 695.......		"	22 31·81		34·14	.....	....		22 43·34
	8	B.J. 699.......		"	33 45·55		46·15	55·34	9·19		33 55·35
	9	111 Herculis...		"	42 55·30		55·56	.....	....		43 04·76
	10	Bradley 2382..		"	44 03·08		05·16	.....	....		44 14·36
	11	B.J. 705.......		"	46 37·66		38·17	47·35	9·18		46 47·37
	12	Groom. 2719..		"	47 52·52		55·04	.....	....		48 04·24
	13	50 Draconis...		"	49 07·65		10·41	.....	....		49 19·61
	14	B.J. 711.......		"	52 27·83		28·56	37·77	9·21		52 37·76
	15	B.J. 713.......		"	55 27·00		27·49	36·56	9·07		55 36·69
	16	51 H. Cephei..		"	58 35·97		22·18	32·35	10·17		....
	17	B.J. 719.......		"	19 03 57·60		58·16	07·40	9·24		19 04 07·36
	18	B.J. 725.......		"	13 28·22		28·39	37·64	9·25	9·21	13 37·60
	19	B.J. 726.......		"	14 53·29		54·28	03·52	....		15 03·49
	20	B.J. 729.......		"	17 08·52		10·92	.....	....		17 20·13
	21	*b* Aquilae		"	20 33·47		33·65	.....	....		20 42·86
	22	ϕ Aquilae		"	51 51·38		51·55	.....	....		52 00·76
	23	B.J. 750.......		"	53 10·24		11·20	20·45	....		53 20·41
	24	B.J. 752.......		"	54 37·91		38·18	47·45	9·27		54 47·39
	25	15 Vulp.......		"	57 16·15		16·55	.....	....		57 25·76
	26	B.D. 69·1084..		"	58 46·82		48·83	.....	....		58 58·04
	27	69 Draconis...		"	20 02 00·29		03·24	.....	....		20 02 12·45
	28	B.J. 760.......		"	12 48·71		49·07	58·22	9·15	9·22	12 58·29
	29	176 B. Cygni..		"	16 51·87		52·48	.....	....		17 01·70
	30	B.J. 765.......		"	18 52·31		52·94	02·09	9·15		19 02·16
	31	40 Cygni......		"	24 06·56		07·16	.....	....		24 16·38
	32	41 Cygni......		"	25 35·63		36·07	.....	....		25 45·29
	33	Groom. 3241..		"	30 16·21		18·48	.....	....		30 27·70
	34	B.J. 770.......		"	32 34·02		36·66	.....	....		32 45·88
	35	B.J. 774.......		"	35 20·27		20·49	29·76	9·27		35 29·71
	36	B.J. 777.......		"	38 14·12		14·87	24·10	9·23		38 24·09
	37	B.J. 780.......		"	42 26·60		27·12	36·42	9·30		42 36·34
	38	B.J. 784		"	43 46·60		47·16	56·39	9·23		43 56·38
	39	76 Draconis...		"	49 00·81		06·07	15·43	9·36		....
	40	220 H^1. Drac..		"	51 33·34		37·52	47·01	9·49		....
Aug. 20	41	B.J. 690.......		S	18 19 43·90	·046	44·25	53·61	9·36	9·38	18 19 53·63
	42	μ Lyrae		"	21 07·69	(·700)	08·36	.....	......		21 17·74
	43	B.J. 694.......		"	22 27·05		28·26	37·67	......		22 37·64
	44	B.J. 699.......	r	"	33 45·33		45·93	55·32	9·39		33 55·31
	45	B.J. 703.......		"	41 39·51		39·84	49·23	9·39		41 49·22
	46	111 Herculis...		"	42 55·05		55·35	.....	....		43 04·73
	47	204 B. Drac...		"	44 34·00		34·96	.....	....		44 44·34
	48	B.J. 705.......		"	46 37·31		37·86	47·34	9·48		46 47·24
	49	B.J. 707.......		"	49 43·79		45·02	54·51	....		49 54·40

Clamp East. 1—40. Adopted $\Delta T+m=9{\cdot}204+{\cdot}0094\ (T-19^h\ 00^m)$.
41—49. Adopted $\Delta T+m=9{\cdot}394+{\cdot}0102\ (T-19^h\ 45^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Aug. 20	1	B.J. 711.......		S	18 52 27·58	·046	28·35	37·75	9·40	9·39	18 52 37·74
	2	B.J. 713.......		"	55 26·63	(·700)	27·17	36·55	9·38		55 36·56
	3	51 H. Cephei..	L.C.,nr	"	58 36·63		22·48	32·75	10·27		....
	4	B.J. 719.......		"	19 03 57·40		58·00	07·38	9·38		19 04 07·39
	5	19 Lyrae......	r	"	08 11·07		11·52	......	....		08 20·91
	6	B.J. 725.......		"	13 28·02		28·22	37·63	9·41		13 37·61
	7	B.J. 726.......		"	14 53·07		54·05	03·50	....		15 03·44
	8	159 B. Lyrae..		"	15 49·54		50·24	......	....		15 59·63
	9	21 B. Vulp....		"	21 34·55		34·95	......	....		21 44·34
	10	4 Cygni.......		"	22 46·66		47·26	......	....		22 56·65
	11	α Vulp........		"	24 49·91		50·31	......	....		24 59·70
	12	B.J. 732.......		"	26 57·74		58·19	07·56	9·37		27 07·58
	13	8 Cygni.......		"	28 17·76		18·33	......	....		28 27·72
	14	ε Sagittae..		"	33 05·45		05·72	......	....		33 15·11
	15	β Sagittae.....		"	36 52·87		53·16	......	....		37 02·55
	16	10 Vulp.......		"	39 50·67		51·09	......	....		40 00·48
	17	B.J. 740.......		"	40 53·93		54·55	03·93	9·38		41 03·94
	18	B.J. 742.......		"	42 01·63		02·43	11·87	9·44		42 11·82
	19	B.J. 743.......		"	43 15·00		15·30	24·62	9·32		43 24·69
	20	ζ Sagittae.....		"	44 51·41		51·72	......	....		45 01·11
	21	φ Aquilae.....		"	51 51·17		51·37	......	....	9·40	52 00·77
	22	B.J. 765.......		"	20 18 52·00		52·69	02·08	9·39		20 19 02·09
	23	40 Cygni......		"	24 06·34		06·98	......	....		24 16·38
	24	41 Cygni......		"	25 35·40		35·89	......	....		25 45·29
	25	ω^1 Cygni......		"	27 08·31		09·15	......	....		27 18·55
	26	B.J. 768.......		"	28 47·51		47·70	57·09	9·39		28 57·10
	27	ζ Delphini.....		"	30 58·66		58·91	......	....		31 08·31
	28	B.J. 771.......	r	"	33 12·39		12·59	22·00	9·41		33 21·99
	29	29 Vulp.......		"	34 22·61		22·95	......	....		34 32·35
	30	B.J. 774.......		"	35 20·06		20·33	29·75	9·42		35 29·73
	31	B.J. 777.......		"	38 13·86		14·66	24·09	9·43		38 24·06
	32	B.J. 778.......		"	39 08·08		08·33	17·72	9·39		39 17·73
	33	B.J. 780.......		"	42 26·42		26·98	36·42	9·44		42 36·38
	34	B.J. 784.......	r	"	43 46·37		46·91	56·39	9·48		43 56·31
	35	76 Draconis...	nr	"	49 00·33		05·71	15·35	9·64		....
	36	220 H^1.Drac...	nr	"	51 33·17		37·45	46·96	9·51	9·41	....
	37	B.J. 788.......		"	53 41·21		41·91	51·33	9·42		53 51·32
	38	f^1 Cygni.......		"	56 38·00		38·80	......	....		56 48·21
	39	B.J. 792.......		"	21 01 31·52		32·29	41·74	9·45		21 01 41·70
	40	B.J. 793.......		"	02 44·19		44·83	54·22	9·39		02 54·24
	41	B.J. 797.......		"	08 58·75		59·23	08·59	9·36		09 08·64
	42	B.J. 799.......		"	11 04·12		04·75	14·17	9·42		11 14·16
	43	υ Cygni.......		"	14 05·28		05·85	......	....		14 05·26
	44	B.A.C. 7504...	nr	"	17 28·93		41·55	50·78	9·23		....
	45	69 Cygni......		"	21 58·57		59·17	......	....		22 08·58
	46	B.J. 807.......		"	25 59·81		00·58	10·02	....		26 09·99
	47	72 Cygni......		"	30 58·16		58·80	......	....		31 08·21
Aug. 26	48	δ Urs. Min....	nr	N	18 00 57·80	·047	09·89	20·71	10·82	10·95	....
	49	B.J. 681.......		"	03 52·19	(·679)	52·62	03·55	10·93		18 04 03·57

Clamp East. 1—47. Adopted $\Delta T+m=9{\cdot}394+{\cdot}0102$ ($T-19^h\ 45^m$).
48, 49. Adopted $\Delta T+m=10{\cdot}965+{\cdot}0120$ ($T-19^h\ 00^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Aug. 26	1	40 Draconis...		N	18 06 33·92	·047	37·99	......	......	10·95	18 06 48·94
	2	B.J. 684.......		"	12 40·87	(·679)	41·56	52·42	10·86	10·96	12 52·52
	3	446 B. Herc...		"	18 14·00		14·34	......	......		18 25·30
	4	B.J. 690.......		"	19 42·26		42·58	53·52	10·94		19 53·54
	5	μ Lyrae......		"	21 06·04		06·67	......	......		21 17·63
	6	B.J. 694.......		"	22 25·24		26·45	37·47	......		22 37·41
	7	B.J. 699.......		"	33 43·64		44·25	55·21	10·96		33 55·21
	8	B.J. 703.......		"	41 37·91		38·21	49·15	10·94		41 49·17
	9	111 Herculis...		"	42 53·50		53·77	......	......		43 04·73
	10	204 B. Drac...		"	44 32·19		33·17	......	......		44 44·13
	11	B.J. 705.......		"	46 35·74		36·25	47·25	11·00		46 47·21
	12	B.J. 707.......		"	49 41·99		43·22	54·32	......		49 54·18
	13	B.J. 711.......		"	52 25·86		26·58	37·63	11·05		52 37·54
	14	B.J. 713.......		"	55 25·02		25·51	36·46	10·95		55 36·47
	15	51 H. Cephei..	L.C.,nr	"	58 38·04		24·32	35·07	10·75		....
	16	B.J. 719.......		"	19 03 55·76		56·32	07·29	10·97	10·97	19 04 07·29
	17	19 Lyrae......		"	08 09·32		09·79	......	......		08 20·76
	18	B.J. 725.......		"	13 26·33		26·51	37·58	11·07		13 37·48
	19	B.J. 726.......		"	14 51·27		52·26	03·36	......		15 03·23
	20	b Aquilae.....		"	20 31·69		31·87	......	......		20 42·84
	21	21 B. Vulp....		"	21 32·97		33·33	......	......		21 44·30
	22	4 Cygni.......		"	22 45·03		45·59	......	......		22 56·56
	23	α Vulp........		"	24 48·24		48·60	......	......		24 59·57
	24	B.J. 732.......		"	26 56·11		56·53	07·49	10·96		27 07·50
	25	8 Cygni.......		"	28 16·11		16·63	......	......		28 27·60
	26	B.D. 49·3059..		"	33 21·36		22·25	......	......		33 33·22
	27	B.J. 738......		"	33 51·79		52·68	03·70	......		34 03·65
	28	14 Cygni......		"	36 21·03		21·72	......	......		36 32·69
	29	10 Vulp.......		"	39 49·11		49·49	......	......		40 00·46
	30	B.J. 740.......		"	40 52·29		52·88	03·86	10·98		41 03·85
	31	B.J. 742.......		"	42 00·03		00·78	11·78	11·00		42 11·75
	32	B.J. 743.......		"	43 13·29		13·56	24·58	11·02		43 24·53
	33	ζ Sagittae.....		"	44 49·81		50·09	......	......		45 01·06
	34	ϕ Aquilae.....		"	51 49·56		49·74	......	......	10·98	52 00·72
	35	B.J. 750.......		"	53 08·32		09·28	20·32	......		53 20·26
	36	B.J. 752.......		"	54 36·12		36·41	47·40	10·99		54 47·39
	37	15 Vulp.......		"	57 14·34		14·75	......	......		57 25·73
Aug. 29	38	ψ^2 Draconis...		N	17 56 31·84	·044	34·16	......	......	11·84	17 56 46·00
	39	δ Urs. Min....	nr	"	18 00 54·83	(·711)	07 44	19·41	11·99		....
	40	B.J. 681.......		"	03 51·21		51·65	03·50	11·85		18 04 03·49
	41	40 Draconis...		"	06 32·27		36·51	......	......		06 48·35
	42	B.J. 684.......		"	12 39·77		40·49	52·36	11·87		12 52·33
	43	446 B. Herc...		"	18 12·98		13·34	......	......		18 25·18
	44	B.J. 690.......		"	19 41·34		41·67	53·48	11·81		19 53·51
	45	μ Lyrae......		"	21 05·07		05·71	......	......		21 17·55
	46	B.J. 693.......		"	21 50·49		52·71	......	......		22 04·55
	47	B.J. 695.......		"	22 28·14		30·55	......	......		22 42·39
	48	B.J. 699.......	r	"	33 42·67		43·30	55·15	11·85		33 55·14
	49	B.J. 703.......		"	41 36·95		37·26	49·11	11·85	11·85	41 49·11

Clamp East. 1—37. Adopted $\Delta T+m=10\cdot965+\cdot0120\ (T-19^h\ 00^m)$.
38—49. Adopted $\Delta T+m=11\cdot856+\cdot0131\ (T-19^h\ 30^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Aug. 29	1	111 Herculis...		N	18 42 52·54	·044	52·81	.....	....	11·85	18 43 04·66
	2	Bradley 2382..		"	43 59·53	(·711)	01·68	.....	....		44 13·53
	3	B.J. 705.......		"	46 34·76		35·29	47·20	11·91		46 47·14
	4	Groom. 2719..		"	47 49·09		51·70	.....	....		48 03·55
	5	50 Draconis...		"	49 04·31		07·18	.....	....		49 19·03
	6	B.J. 711.......		"	52 24·92		25·67	37·57	11·90		52 37·52
	7	B.J. 713.......		"	55 24·06		24·57	36·42	11·85		55 36·42
	8	51 H. Cephei..	L.C.,nr	"	58 38·17		23·84	36·47	12·63		....
	9	B.J. 719.......		"	19 03 54·79		55·37	07·24	11·87		19 04 07·22
	10	λ Urs. Min....		"	10 18·74		01·77	13·80	12·03		....
	11	B.J. 726.......		"	14 50·30		51·33	03·29	....		15 03·18
	12	B.J. 729.......		"	17 05·21		07·69	.....	....		17 19·54
	13	*b* Aquilae.....		"	20 30·78		30·97	.....	....		20 42·82
	14	21 B. Vulp....		"	21 32·02		32·40	.....	....		21 44·27
	15	4 Cygni.......		"	22 44·12		44·70	.....	....		22 56·55
	16	B.D. 76·734...		"	24 33·83		36·93	.....	....		24 48·78
	17	B.J. 734.......		"	26 56·15		00·15	.....	....	11·86	27 12·01
	18	8 Cygni.......		"	28 15·20		15·74	.....	....		28 27·60
	19	B.D. 70·1073..		"	31 31·96		34·12	.....	....		31 45·98
	20	B.D. 49·3059..		"	33 20·34		21·26	.....	....		33 33·12
	21	B.J. 738.......		"	33 50·86		51·78	03·64	....		34 03·64
	22	14 Cygni.......		"	36 20·06		20·78	.....	....		36 32·64
	23	10 Vulp.......		"	39 48·16		48·55	.....	....		40 00·41
	24	B.J. 740.......		"	40 51·42		52·02	03·82	11·80		41 03·88
	25	B.J. 742.......		"	41 59·04		59·82	11·73	11·91		42 11·68
	26	B.J. 743.......		"	43 12·40		12·67	24·56	11·89		43 24·53
	27	ζ Sagittae......		"	44 48·86		49·14	.....	....		45 01·00
	28	B.J. 747.......		"	48 17·46		19·54	.....	....		48 31·40
	29	φ Aquilae.....		"	51 48·68		48·86	.....	....		52 00·72
	30	B.J. 750.......		"	53 07·38		08·38	20·26	....		53 20·24
	31	B.J. 752.......		"	54 35·28		35·57	47·38	11·81		54 47·43
	32	15 Vulp.......		"	57 13·43		13·85	.....	....		57 25·71
	33	B.D. 69·1084..		"	58 43·85		45·93	.....	....		58 57·79
	34	Groom. 1119..	L.C.,nr	"	20 08 46·71		10·03	20·71	10·68		....
	35	176 B. Cygni..		"	16 49·07		49·71	.....	....	11·87	20 17 01·58
	36	B.J. 765.......		"	18 49·45		50·11	01·99	11·88		19 01·98
	37	40 Cygni......		"	24 03·79		04·41	.....	....		24 16·28
	38	41 Cygni......		"	25 32·92		33·38	.....	....		25 45·25
	39	ω¹ Cygni......		"	27 05·69		06·57	.....	....		27 18·44
	40	B.J. 768.......		"	28 45·00		45·18	57·06	11·88		28 57·05
	41	Groom. 3241..		"	30 12·91		15·26	.....	....		30 27·13
	42	B.J. 770.......		"	32 30·79		33·52	.....	....		32 45·39
	43	74 Draconis...		"	34 29·83		34·43	.....	....		34 46·30
	44	B.J. 777.......		"	38 11·37		12·15	24·01	11·86		38 24·02
	45	B.J. 780.......		"	42 23·91		24·45	36·38	11·93		42 36·32
	46	B.J. 784.......		"	43 43·96		44·54	56·34	11·80		43 56·41
	47	76 Draconis...	nr	"	48 57·35		02·80	14·70	11·90		....
	48	220 H¹.Drac...		"	51 29·98		34·31	.....	....		51 46·18
	49	B.J. 788.......		"	53 38·63		39·30	51·28	11·98		53 51·17
	50	Bradley 2748..		"	55 37·12		40·04	.....	....		55 51·91

Clamp East. 1—50. Adopted $\Delta T+m=11{\cdot}856+{\cdot}0131\ (T-19^h\ 30^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Aug. 31	1	B.J. 757		N	20 10 36·63	·043	37·45	49·93		12·41	20 10 49·86
	2	B.J. 760		"	12 45·35	(·710)	45·72	58·14	12 42		12 58·13
	3	176 B. Cygni		"	16 48·49		49·12				17 01·53
	4	B.J. 765		"	18 48·91		49·57	01·97	12·40	12·42	19 01·99
	5	40 Cygni		"	24 03·28		03·90				24 16·32
	6	41 Cygni		"	25 32·37		32·83				25 45·25
	7	ω^1 Cygni		"	27 05·11		05·99				27 18·41
	8	B.J. 768		"	28 44·41		44·58	57·05	12·47		28 57·00
	9	ζ Delphini		"	30 55·60		55·82				31 08·24
	10	B.J. 770		"	32 30·52		33·24				32 45·66
	11	74 Draconis		"	34 29·17		33·75				34 46·17
	12	B.J. 777		"	38 10·77		11·55	23·99	12·44		38 23·97
	13	B.J. 778		"	39 05·10		05·32	17·69	12·37		39 17·74
	14	B.J. 780		"	42 23·37		23·91	36·36	12·45		42 36·33
	15	B.J. 784		"	43 43·30		43·88	56·32	12·44		43 56·30
	16	76 Draconis	nr	"	48 56·59		02·02	14·48	12·46		....
	17	B.J. 788		"	53 38·10		38·77	51·26	12·49		53 51·19
	18	Bradley 2748		"	55 36·68		39·58				55 52·00
	19	B.J. 792		"	21 01 28·47		29·21	41·67	12·46	12·43	21 01 41·64
	20	B.J. 793		"	02 41·16		41·78	54·18	12·40		02 54·21
	21	f^2 Cygni		"	03 19·09		19·93				03 32·36
	22	Groom. 3409		"	05 39·69		41·88				05 54·31
	23	B.J. 798		"	09 19·51		20·81	33·29			09 33·24
	24	B.J. 799		"	11 01·10		01·71	14·13	12·42		11 14·14
	25	σ Cygni		"	13 41·99		42·62				13 55·05
	26	B.A.C. 7504	nr	"	17 23·57		36·31	49·20	12·89		....
	27	69 Cygni		"	21 55·55		56·13				22 08·56
	28	1 H. Draconis	L.C., nr	"	24 09·55		04·73	17·27	12·54		....
	29	B.J. 809		"	27 18·70		20·79				27 33·22
	30	ρ Cygni		"	30 24·72		25·51				30 37·94
	31	B.J. 811		"	33 09·67		10·33	22·75	12·42		33 22·76
	32	B.J. 813		"	35 58·84		00·02	12·62			36 12·45
	33	B.J. 817		"	40 24·96		27·13				40 39·56
	34	78 Draconis		"	41 47·16		49·45				42 01·88
	35	B.J. 821		"	43 17·11		18·00	30·45			43 30·43
	36	14 Pegasi		"	45 41·23		41·68			12.44	45 54·12
	37	B.J. 823		"	48 47·44		47·83	00·32	12·49		49 00·27
	38	Bradley 2868		"	49 53·96		55·08				50 07·52
	39	79 Draconis		"	51 32·78		35·27				51 47·71
	40	Bradley 2897		"	56 48·45		51·16				57 03·60
	41	B.J. 831		"	22 02 38·79		39·17	51·59	12·42		22 02 51·61
	42	B.J. 833		"	05 03·64		04·15	16·66	12·51		05 16·59
	43	B.J. 835		"	05 48·76		49·27	01·69	12·42		06 01·71
	44	B.J. 836		"	07 32·80		34·00	46·46			07 46·44
	45	1 H. Lacertae		"	09 50·18		50·82				10 03·26
	46	B.A.C. 3495	L.C., nr	"	16 31·51		23·94	36·60	12·66		....
Sept. 1	47	B.J. 693		S	18 21 49·34	·056	51·56			12·81	18 22 04·37
	48	B.J. 700		"	33 51·54	(·723)	54·91				34 07·72
	49	Bradley 2382		"	43 58·30		00·46			12·82	44 13·28

Clamp East. 1—46. Adopted $\Delta T+m=12{\cdot}427+{\cdot}0138\ (T-21^h\ 10^m)$.
47—49. Adopted $\Delta T+m=12{\cdot}836+{\cdot}0142\ (T-20^h\ 10^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 1	1	B.J. 705.......		S	18 46 33·72	·056	34·30	47·14	12·84	12·82	18 46 47·12
	2	Groom. 2719..		"	47 47·72	(·723)	50·33	.....	....		48 03·15
	3	50 Draconis...		"	49 02·96		05·83	.....	....		49 18·65
	4	B.D. 79·604...		"	51 44·92		49·09	.....	....		52 01·91
	5	B.J. 714.......		"	55 16·92		19·14	.....	....		55 31·96
	6	51 H. Cephei..	L.C.,rn	"	58 39·59		24·79	37·97	13·18		....
	7	B.J. 719.......		"	19 03 53·75		54·38	07·19	12·81		19 04 07·20
	8	λ Urs. Min....	rn	"	10 12·39		56·78	09·81	13·03		....
	9	B.J. 726.......		"	14 49·31		50·34	03·21	....		15 03·16
	10	B.J. 729.......		"	17 04·02		06·51	.....	....		17 19·33
	11	4 Cygni.......		"	22 43·04		43·67	.....	....		22 56·49
	12	B.D. 76·734...		"	24 32·53		35·62	.....	....	12·83	24 48·45
	13	B.J. 734.......		"	26 54·90		58·91	.....	....		27 11·74
	14	8 Cygni.......		"	28 14·10		14·69	.....	....		28 27·52
	15	B.D. 70·1073..		"	31 30·71		32·87	.....	....		31 45·70
	16	B.D. 49·3059..	r	"	33 19·27		20·26	.....	....		33 33·09
	17	B.J. 738.........		"	33 49·77		50·69	03·57	....		34 03·52
	18	14 Cygni......		"	36 19·04		19·75	.....	....		36 32·58
	19	B.J. 740.......		"	40 50·27		50·93	03·77	12·84		41 03·76
	20	B.J. 742.......		"	41 57·98		58·82	11·67	12·85		42 11·65
	21	B.J. 759.......		"	20 11 42·99		46·35	.....	....	12·84	20 11 59·19
	22	176 B. Cygni..		"	16 47·97		48·67	.....	....		17 01·51
	23	B.J. 765.......	r	"	18 48·47		49·13	01·95	12·82		19 01·97
	24	40 Cygni......		"	24 02·74		03·42	.....	....		24 16·26
	25	41 Cygni......		"	25 31·82		32·34	.....	....		25 45·18
	26	ω^1 Cygni......		"	27 04·70		05·58	.....	....		27 18·42
	27	Groom. 3241..		"	30 11·85		14·19	.....	....		30 27·03
	28	B.J. 770.......		"	32 29·65		32·38	.....	....		32 45·22
	29	74 Draconis...	rn	"	34 28·50		33·24	.....	....		34 46·08
	30	B.J. 777.......		"	38 10·30		11·14	23·97	12·83		38 23·98
	31	B.J. 780.......	r	"	42 22·98		23·50	36·35	12·85		42 36·34
	32	B.J. 784.......		"	43 42·78		43·41	56·31	12·90		43 56·25
	33	76 Draconis...	rn	"	48 55·80		01·43	14·37	12·94	12·85	....
	34	220 H¹. Drac..	rn	"	51 28·62		33·09	46·21	13·12		....
	35	B.J. 788.......		"	53 37·67		38·40	51·25	12·85		53 51·25
	36	Bradley 2748..		"	55 36·07		38·98	.....	....		55 51·83
	37	B.J. 792.......		"	21 01 27·95		28·76	41·66	12·90		21 01 41·61
	38	f^2 Cygni		"	03 18·60		19·44	.....	....		03 32·29
	39	Groom. 3409..		"	05 39·19		41·39	.....	....		05 54·24
	40	B.J. 795.......		"	07 06·28		09·73	.....	....		07 22·58
	41	B.J. 798.......		"	09 19·07		20·38	33·27	....		09 33·23
	42	B.J. 799.......		"	11 00·61		01·28	14·13	12·85		11 14·13
	43	σ Cygni.......		"	13 41·46		42·16	.....	....		13 55·01
	44	Bradley 2796..		"	16 29·51		32·66	.....	....		16 45·51
	45	69 Cygni......		"	21 55·06		55·69	.....	....		22 08·54
	46	1 H. Draconis	L.C.,rn	"	24 09·08		04·09	17·37	13·28		....
	47	B.J. 807.......		"	25 56·27		57·07	09·98	....		26 09·92
	48	B.J. 809.......		"	27 18·19		20·28	.....	....		27 33·13
	49	ρ Cygni.......		"	30 24·32		25·17	.....	....	12·86	30 38·03
	50	B.J. 811.......		"	33 09·11		09·83	22·74	12·91		33 22·69

Clamp East. 1—50. Adopted $\Delta T+m=12{\cdot}836+{\cdot}0142\ (T-20^{h}\ 10^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 1	1	B.J. 813.......		S	21 35 58·54	·056	59·71	12·61	....	12·86	21 36 12·57
	2	B.J. 817.......		"	40 24·59	(·723)	26·77	.....	....		40 39·63
	3	78 Draconis...	r	"	41 46·49		48·94	.....	....		42 01·80
	4	B.J. 821.......		"	43 16·69		17·58	30·44	....		43 30·44
	5	Bradley 2868..		"	49 53·52		54·64	.....	....		50 07·50
	6	79 Draconis...		"	51 32·06		34·57	.....	....		51 47·43
	7	Bradley 2897..	r	"	56 47·69		50·58	.....	....		57 03·44
Sept. 2	8	B.J. 703.......		N	18 41 35·63	·041	35·95	49·05	13·10	13·08	18 41 49·03
	9	111 Herculis...		"	42 51·17	(·758)	51·46	.....	....		43 04·54
	10	Bradley 2382..		"	43 57·92		00·20	.....	....		44 13·28
	11	B.J. 705.......		"	46 33·47		34·02	47·12	13·10		46 47·10
	12	Groom. 2719..		"	47 47·49		50·26	.....	....		48 03·34
	13	50 Draconis...		"	49 02·63		05·67	.....	....		49 18·75
	14	B.D. 79·604...		"	51 44·47		48·89	.....	....		52 01·97
	15	B.J. 714.......		"	55 16·57		18·90	.....	....		55 31·98
	16	51 H. Cephei..	L.C.,nr	"	58 39·67		24·44	38·44	14·00		....
	17	B.J. 719.......		"	19 03 53·39		54·00	07·17	13·17		19 04 07·08
	18	λ Urs. Min.....		"	10 08·02		53·60	08·56	14·96	13·09	....
	19	B.J. 726.......		"	14 49·04		50·13	03·18	......		15 03·22
	20	b Aquilae.		"	20 29·44		29·64	.....	....		20 42·73
	21	21 B. Vulp....		"	21 30·69		31·09	....	......		21 44·18
	22	4 Cygni.......		"	22 42·76		43·37	.....	....		22 56·46
	23	α Vulp........		"	24 46·04		46·44	.....	....		24 59·53
	24	B.J. 732.......		"	26 53·91		54·36	07·40	13·04		27 07·45
	25	8 Cygni.......		"	28 13·82		14·39	.....	....		28 27·48
	26	B.D. 49·3059..		"	33 19·01		19·98	.....	....		33 33·07
	27	B.J. 738.......		"	33 49·47		50·44	03·55	....		34 03·53
	28	14 Cygni......		"	36 18·75		19·51	.....	....		36 32·60
	29	10 Vulp.......		"	39 46·85		47·26	....	....		40 00·35
	30	B.J. 740.......		"	40 50·01		50·65	03·76	13·11		41 03·74
	31	B.J. 742.......		"	41 57·69		58·51	11·65	13·14		42 11·60
	32	B.J. 743.......		"	43 11·21		11·50	24·51	13·01		43 24·59
	33	ζ Sagittae.....		"	44 47·62		47·92	.....	....		45 01·01
	34	φ Aquilae		"	51 47·41		47·60	....	....	13·10	52 00·70
	35	B.J. 750.......		"	53 06·04		07·09	20·17	....		54 20·19
	36	B.J. 752.......		"	54 33·97		34·28	47·34	13·06		54 47·38
	37	15 Vulp.......		"	57 12·08		12·52	.....	....		57 25·62
	38	b^2 Cygni.		"	20 05 53·35		53·97	.....	....		20 06 07·07
	39	20 Vulp.......		"	08 02·78		03·20	.....	....		08 16·30
	40	B.J. 757.......		"	10 35·92		36·79	49·90	....		10 49·89
	41	B.J. 760.......		"	12 44·65		45·04	58·12	13·08		12 58·14
	42	176 B. Cygni..		"	16 47·64		48·31	....	....		17 01·41
	43	B.J. 765.......		"	18 48·17		48·87	01·94	13·07		19 01·97
	44	40 Cygni......		"	24 02·56		03·22	.....	....		24 16·32
	45	41 Cygni......		"	25 31·53		32·02	.....	....		25 45·12
	46	ω^1 Cygni......		"	27 04·34		05·27	.....	....		27 18·37
	47	B.J. 768.......		"	28 43·82		44·00	57·04	13·04		28 57·10
	48	ζ Delphini.....		"	30 55·01		55·25	.....	....	13·11	31 08·36
	49	B.J. 771.......		"	33 08·66		08·89	21·95	13·06		33 22·00

Clamp East. 1—7. Adopted $\Delta T+m=12{\cdot}836+{\cdot}0142$ (T$-20^h\ 10^m$).
8—49. Adopted $\Delta T+m=13{\cdot}098+{\cdot}0145$ (T$-20^h\ 00^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 2	1	29 Vulp		N	20 34 18·95	·041	19·28	.....	....	13·11	20 34 32·39
	2	B.J. 774		"	35 16·40	(·758)	16·65	29·70	13·05		35 29·76
	3	B.J. 777		"	38 09·97		10·79	23·96	13·17		38 23·90
	4	B.J. 778		"	39 04·32		04·56	17·67	13·11		39 17·67
	5	B.J. 780		"	42 22·59		23·15	36·34	13·19		42 36·26
	6	B.J. 784		"	43 42·56		43·17	56·30	13·13		43 56·28
	7	76 Draconis	nr	"	48 55·31		01·09	14·27	13·18		....
	8	220 H[1]. Drac		"	51 28·29		32·88	.....	....		51 45·99
	9	B.J. 788		"	53 37·35		38·06	51·24	13·18		53 51·17
	10	f^1 Cygni		"	56 34·04		34·93	.....	....		56 48·04
	11	B.J. 792		"	21 01 27·69		28·47	41·65	13·18		21 01 41·58
	12	B.J. 793		"	02 40·42		41·08	54·16	13·08		02 54·19
	13	B.J. 799		"	11 00·30		00·94	14·12	13·18	13·12	11 14·06
	14	σ Cygni		"	13 41·23		41·90	.....	....		13 55·02
	15	B.J. 804		"	17 44·31		44·62	57·74	13·12		17 57·74
	16	69 Cygni		"	21 54·74		55·35	.....	....		22 08·47
	17	1 H. Draconis	L.C., nr	"	24 09·46		04·33	17·46	13·13		....
	18	B.J. 807		"	25 55·97		56·83	09·97	....		26 09·95
Sept. 7	19	B.J. 891		S	23 33 29·71	·053	30·46	45·68	15·22	15·16	23 33 45·62
	20	κ Andromedae		"	35 44·87	(·691)	45·64	.....	....		36 00·80
	21	ψ Andromedae		"	41 20·83		21·59	.....	....		41 36·75
	22	B.J. 898		"	47 41·39		41·70	56·89	15·19		47 56·86
	23	B.J. 899		"	49 39·43		40·55	55·76	....		49 55·71
	24	ψ Pegasi		"	52 57·09		57·49	.....	....		53 12·65
	25	Bradley 1672	L.C., nr	"	0 14 08·76		46·77	01·45	14·68	15·17	....
	26	B.J. 18		"	31 50·92		51·47	06·68	15·21		0 32 06·64
	27	B.J. 19		"	33 34·54		35·01	50·21	15·20		33 50·18
	28	B.J. 21		"	35 10·10		11·19	26·42	....		35 26·36
	29	B.J. 25		"	39 28·86		29·67	44·91	....		39 44·84
	30	B.J. 27		"	42 20·72		21·10	36·30	15·20		42 36·27
	31	η Cass		"	43 25·74		26·88	.....	....		43 42·05
	32	ν Andromedae		"	44 37·32		38·02	.....	....		44 53·19
	33	32[2] H. Camel.	L.C., nr	"	48 12·08		05·61	20·86	15·25		....
	34	B.J. 33		"	51 31·85		32·49	47·69	15·20		51 47·66
	35	h Piscium		"	52 44·43		44·89	.....	....		53 00·06
	36	43 H. Cephei	nr	"	56 03·41		13·34	28·74	15·40	15·18	....
	37	72 Piscium		"	1 00 07·07		07·32	.....	....		1 00 22·50
	38	μ Cass		"	03 03·41		04·44	.....	....		03 19·62
	39	B.J. 42		"	04 28·01		28·59	43·76	15·17		04 43·77
	40	χ Piscium		"	06 23·65		23·99	.....	....		06 39·17
	41	B.J. 45		"	14 17·71		18·15	33·32	15·17		14 33·33
	42	l Piscium		"	15 55·28		55·74	.....	....		16 10·92
	43	B.J. 48		"	19 41·56		42·81	58·12	....		19 57·99
	44	ω Andromedae		"	22 02·48		03·28	.....	....		22 18·46
	45	α Urs. Min.	nr.	"	26 47·04		22·78	37·27	14·49		....
	46	B.J. 57		"	37 47·24		48·12	03·37	....		38 03·30
	47	2 Persei		"	46 12·00		12·89	.....	....	15·19	46 28·08
	48	B.J. 66		"	49 26·64		26·98	42·15	15·17		49 42·17
	49	B.J. 73		"	58 08·64		09·37	24·57	15·20		59 24·56

Clamp East. 1—18. Adopted $\Delta T+m=13{\cdot}098+{\cdot}0145$ ($T-20^h\ 00^m$).
19—49. Adopted $\Delta T+m=15{\cdot}179+{\cdot}0125$ ($T-1^h\ 15^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date.	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 7	1	B.J. 74........		S	2 01 52·45	·053	52·83	08·01	15·18	15·19	2 02 08·20
	2	B.J. 75........		"	03 57·58	(·691)	58·16	13·32	15·16		04 13·35
	3	B.J. 77........		"	07 23·23		24·12	39·33	....		07 39·31
	4	B.J. 79........		"	11 44·15		44·71	59·84	15·13		11 59·90
	5	ξ Arietis......		"	19 46·16		46·35	....	....		20 01·54
	6	27 Arietis...		"	25 41·30		41·59	....	....		25 56·78
	7	B.J. 89........		"	33 28·72		29·08	44·26	15·18	15·20	33 44·28
	8	B.J. 93........		"	37 49·19		50·03	05·20	....		38 05·23
	9	39 Arietis.....		"	42 19·16		19·63	....	....		42 34·83
	10	B.J. 99........		"	43 53·70		54·77	09·99	....		44 09·97
	11	σ Arietis......		"	46 17·78		18·03	....	....		46 33·23
	12	B.J. 103.......		"	47 38·47		39·43	54·62	....		47 54·63
	13	ε Arietis......		"	53 50·19		50·53	....	....		54 05·73
	14	B.J. 108.......		"	58 02·46		03·44	18·68	....		58 18·64
	15	B.J. 109.......		"	59 10·57		11·22	26·44	15·22		59 26·42
	16	B.J. 112.......		"	3 02 20.38		21·23	36·35	....		3 02 36·43
	17	Groom. 2283..	L.C.,nr	"	05 44·15		27·77	43·27	15·50		....
	18	ζ Arietis......		"	09 29·95		30·29	....	....		09 45·49
	19	τ^1 Arietis...		"	15 48·00		48·34	....	....		16 03·54
Sept. 8	20	α Vulp........		S	19 24 43·62	·055	44·03	....	....	15·41	19 24 59·44
	21	B.J. 732.......		"	26 51·45	(·702)	51·91	07·31	15·40		27 07·32
	22	8 Cygni.......		"	28 11·42		12·00	....	....		28 27·41
	23	B.J. 760.......		"	20 12 42·16		42·57	58·05	15·48	15·42	20 12 57·99
	24	176 B. Cygni..		"	16 45·35		46·03	....	....		17 01 45
	25	B.J. 765.......		"	18 45·74		46·44	01·86	15·42		19 01·86
	26	40 Cygni......	r	"	24 00·18		00·78	....	....		24 16·20
	27	41 Cygni......		"	25 29·21		29·71	....	....		25 45·13
	28	ω^1 Cygni		"	27 02·00		02·85	....	....		27 18·27
	29	B.J. 768.......		"	28 41·37		41·57	57·00	15·43		28 56·99
	30	ζ Delphini.....	r	"	30 52·60		52·81	....	....		31 08·23
	31	B.J. 771.......		"	33 06·21		06·47	21·91	15·44		34 21·89
	32	29 Vulp.......		"	34 16·45		16·80	....	....		34 32·22
	33	B.J. 774.......		"	35 13·96		14·24	29·66	15·42		35 29·66
	34	B.J. 777.......		"	38 07·61		08·43	23·88	15·45		38 23·85
	35	B.J. 780.......		"	42 20·29		20·86	36·28	15·42		42 36·28
	36	B.J. 784.......	r	"	43 40·25		40·81	56·24	15·43		43 56·23
	37	76 Draconis...	rn	"	48 52·76		58·23	13·72	15·49		....
	38	220 H^1.Drac...	rn	"	51 25·81		30·15	45·67	15·52		....
	39	B.J. 788.......		"	53 35·03		35·74	51·17	15·43		53 51·16
	40	f^1 Cygni......		"	56 31·78		32·59	....	....		56 48·01
	41	B.J. 792.......		"	21 01 25·38		26·16	41·59	15·43	15·43	21 01 41·59
	42	f^2 Cygni......		"	03 15·98		16·79	....	....		03 32·22
	43	B.J. 798.......		"	09 16·43		17·70	33·15	....		09 33·13
	44	B.J. 799.......		"	10 58·01		58·65	14·08	15·43		11 14·08
	45	υ Cygni.......		"	13 59·16		59·74	....	....		14 15·17
	46	B.A.C. 7504...	rn	"	17 19·47		32·30	47·70	15·40		....
	47	69 Cygni......		"	21 52·49		53·10	....	....		22 08·53
	48	1 H. Draconis	L.C.,rn	"	24 07·14		02·30	17·91	15·61		....
	49	ρ Cygni.......		"	30 21·70		22·53	....	....		30 37·96

Clamp East. 1—19. Adopted $\Delta T+m=15{\cdot}179+{\cdot}0125\ (T-1^h\ 15^m)$.
20—49. Adopted $\Delta T+m=15{\cdot}421+{\cdot}0125\ (T-20^h\ 40^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 8	1	B.J. 811		S	21 33 06·58	·055	07·28	22·71	15·43	15·43	21 33 22·71
	2	B.J. 813		"	35 55·83	(·702)	56·97	12·53	....		36 12·40
	3	B.J. 816		"	40 20·60		21·02	36·44	15·42		40 36·45
	4	B.J. 821		"	43 14·08		14·94	30·40	....		43 30·37
	5	14 Pegasi		"	45 38·11		38·60	.....	....		45 54·03
	6	B.J. 823	r	"	48 44·52		44·90	00·31	15·41	15·44	49 00·34
	7	Bradley 2868		"	49 50·93		52·02	.....	....		50 07·46
	8	13 Cephei		"	51 37·52		38·63	.....	....		51 54·07
	9	B.J. 826		"	56 28·98		29·22	44·67	15·45		56 44·66
Sept. 9	10	50 Draconis		N	18 48 59·46	·051	02·46	.....	....	15·83	18 49 18·29
	11	B.J. 712		"	55 13·44	(·737)	15·75	.....	....		55 31·58
	12	51 H. Cephei	L.C.,nr	"	58 40·11		25·12	41·49	16·37		....
	13	B.J. 719		"	19 03 50·57		51·18	07·03	15·84		19 04 07·02
	14	λ Urs. Min		"	09 58·53		43·48	00·32	16·84		....
	15	B.J. 726		"	14 46·14		47·22	02·98	....		15 03·05
	16	B.J. 729		"	17 00·49		03·09	.....	....		17 18·92
	17	*b* Aquilae		"	20 26·61		26·81	.....	....		20 42·64
	18	21 B. Vulp		"	21 27·89		28·29	.....	....		21 44·12
	19	4 Cygni		"	22 39·94		40·55	.....	....		22 56·38
	20	B.D. 76·734		"	24 28·80		32·03	.....	....		24 47·86
	21	B.J. 734		"	26 50·97		55·14	.....	....		27 10·97
	22	8 Cygni		"	28 10·98		11·54	.....	....	15·84	28 27·38
	23	B.D. 70·1073		"	31 27·22		29·48	.....	....		31 45·32
	24	B.D. 49·3059		"	33 16·18		17·15	.....	....		33 32·99
	25	B.J. 738		"	33 46·60		47·57	03·38	....		34 03·41
	26	14 Cygni		"	36 15·82		16·58	.....	....		36 32·42
	27	10 Vulp		"	39 44·02		44·43	.....	....		40 00·27
	28	B.J. 740		"	40 47·11		47·74	03·64	15·90		41 03·58
	29	B.J. 742		"	41 54·87		55·69	11·51	15·82		42 11·53
	30	B.J. 743		"	43 08·28		08·57	24·43	15·86		43 24·41
	31	ζ Sagittae		"	44 44·71		45·01	.....	....		45 00·85
	32	B.J. 747		"	48 12·74		14·91	.....	....		48 30·75
	33	B.J. 750		"	52 03·20		04·24	20·01	....		52 20·08
	34	B.J. 752		"	54 31·09		31·40	47·26	15·86		54 47·24
	35	15 Vulp		"	57 09·31		09·75	.....	....		57 25·59
	36	B.D. 69·1084		"	58 39·30		41·47	.....	....		58 57·31
	37	69 Draconis		"	20 01 52·04		55·23	.....	....		20 02 11·07
	38	Groom. 1119	L.C.,nr	"	08 51·95		13·56	30·89	17·33		....
	39	176 B. Cygni		"	16 44·86		45·53	.....	....	15·85	17 01·38
	40	B.J. 765		"	18 45·34		46·03	01·84	15·81		19 01·88
	41	41 Cygni		"	25 28·73		29·22	.....	....		25 45·07
	42	ω^1 Cygni		"	27 01·51		02·43	.....	....		27 18·28
	43	Groom. 3241		"	30 08·41		10·86	.....	....		30 26·71
	44	B.J. 770		"	32 26·05		28·90	.....	....		32 44·75
	45	74 Draconis		"	34 24·82		29·62	.....	....		34 45·47
	46	B.J. 777		"	38 07·11		07·93	23·86	15·93		38 23·78
	47	B.J. 778		"	39 01·56		01·80	17·63	15·83		39 17·65
	48	B.J. 780		"	42 19·86		20·42	36·27	15·85		42 36·27
	49	B.J. 784		"	43 39·74		40·35	56·23	15·88		43 56·20

Clamp East. 1—9. Adopted $\Delta T+m=15{\cdot}421+{\cdot}0125\ (T-20^h\ 40^m)$.
10—49. Adopted $\Delta T+m=15{\cdot}846+{\cdot}0125\ (T-20^h\ 20^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 9	1	76 Draconis...		N	20 48 51·93	·051	57·62	13·62	16·00	15·85	....
	2	220 H¹. Drac..		"	51 24·91	(·737)	29·44	.....	....		20 51 45·29
	3	B.J. 788.......		"	53 34·53		35·24	51·16	15·92		53 51·09
	4	Bradley 2748..		"	55 32·66		35·71	.....	....		55 51·56
	5	B.J. 793.......		"	21 02 37·64		38·29	54·10	15·81		21 02 54·14
	6	f^2 Cygni.		"	03 15·50		16·38	.....	....	15·86	03 32·24
	7	Groom. 3409..		"	05 35·87		38·16	.....	....		05 54·02
	8	B.J. 797.......		"	08 52·18		52·66	08·51	15·85		09 08·52
	9	B.J. 799.......		"	10 57·59		58·23	14·06	15·83		11 14·09
	10	σ Cygni......		"	13 38·46		39·13	.....	....		13 54·99
	11	B.J. 804.......		"	17 41·54		41·85	57·71	15·86		17 57·71
	12	69 Cygni......		"	21 51·98		52·59	.....	....		22 08·45
	13	1 H. Draconis	L.C.,nr	"	24 07·28		02·23	17·99	15·76		....
	14	B.J. 807.......		"	25 53·16		54·01	09·91	....		26 09·87
	15	B.J. 809.......		"	27 14·92		17·10	.....	....		27 32·96
	16	ρ Cygni.......		"	30 21·19		22·01	.....	....		30 37·87
	17	B.J. 811.......		"	33 06·12		06·82	22·70	15·88		33 22·68
	18	B.J. 813.......		"	35 55·18		56·42	12·51	....		36 12·28
	19	B.J. 817.......		"	40 21·04		23·31	.....	....		40 39·17
	20	78 Draconis...		"	41 43·36		45·77	.....	....		42 01·63
	21	B.J. 821.......		"	43 13·51		14·44	30·39	....		43 30·30
	22	14 Pegasi.....		"	45 37·63		38·11	.....	....		45 53·97
Sept. 10	23	B.D. 69·1084..		S	19 58 39·05	·056	41·20	.....	....	16·01	19 58 57·21
	24	69 Draconis...		"	20 01 51·85	(·745)	55·00	.....	....		20 02 11·01
	25	b^2 Cygni......		"	05 50·23		50·89	.....	....		06 06·90
	26	30 Cygni......		"	10 13·26		14·11	.....	....		10 30·12
	27	B.J. 759.......		"	11 39·13		42·59	.....	....		11 58·60
	28	176 B. Cygni..		"	16 44·68		45·39	.....	....	16·02	17 01·41
	29	B.J. 765.......	r	"	18 45·10		45·78	01·82	16·04		19 01·80
	30	40 Cygni......		"	23 59·43		00·13	.....	....		24 16·15
	31	41 Cygni......		"	25 28·50		29·03	.....	....		25 45·05
	32	ω^1 Cygni......		"	27 01·31		02·22	.....	....		27 18·24
	33	Groom. 3241..		"	30 08·16		10·57	.....	....		30 26·59
	34	B.J. 770.......		"	32 25·93		28·74	.....	....		32 44·76
	35	74 Draconis...		"	34 24·29		29·03	.....	....		34 45·05
	36	B.J. 777.......		"	38 06·93		07·79	23·84	16·05		38 23·81
	37	B.J. 782.......		"	42 51·87		53·08	09·23	....		43 09·10
	38	76 Draconis...	nr	"	48 51·61		57·40	13·51	16·11		....
	39	220 H¹. Drac..	nr	"	51 24·81		29·41	45·49	16·08		....
	40	B.J. 788.......		"	53 34·34		35·09	51·14	16·05		53 51·11
	41	Bradley 2748..		"	55 32·44		35·44	.....	....		55 51·46
	42	B.J. 792.......		"	21 01 24·62		25·45	41·56	16·11		21 01 41·47
	43	B.J. 793.......		"	02 37·33		38·03	54·09	16·06	16·03	02 54·06
	44	Groom. 3409..		"	05 35·71		37·98	...	....		05 54·01
	45	B.J. 795.......		"	07 02·62		06·17	....	....		07 22·20
	46	B.J. 798.......		"	09 15·71		17·05	33·11	....		09 33·08
	47	B.J. 799.......		"	10 57·32		58·00	14·05	16·05		11 14·03
	48	σ Cygni.......		"	13 38·20		38·91	.....	....		13 54·94
	49	B.A.C. 7504...	nr	"	17 17·01		30·58	47·30	16·72		....

Clamp East. 1—22. Adopted $\Delta T+m=15{\cdot}846+{\cdot}0125\ (T-20^h\,20^m)$.
23—49. Adopted $\Delta T+m=16{\cdot}033+{\cdot}0125\ (T-21^h\,40^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 10	1	69 Cygni......		S	21 21 51·81	·056	52·45	.....	....	16·03	21 22 08·48
	2	1 H. Draconis	L.C.,nr	"	24 07·10	(·745)	01·95	18·09	16·14		....
	3	B.J. 807.......		"	25 53·00		53·82	09·90	....		26 09·85
	4	B.J. 809.......		"	27 14·80		16·95	.....	....		27 32·98
	5	72 Cygni......		"	30 51·43		52·13	.....	....		31 08·16
	6	B.J. 811.......		"	33 05·89		06·63	22·69	16·06		33 22·66
	7	B.J. 813.......		"	35 55·24		56·45	12·50	....		36 12·48
	8	B.J. 817.......	r	"	40 21·07		23·45	.....	....		40 39·48
	9	78 Draconis...		"	41 43·31		45·68	.....	....		42 01·71
	10	B.J. 821.......		"	43 13·42		14·34	30·38	....		43 30·37
	11	Bradley 2868..		"	49 50·33		51·48	.....	....	16·04	50 07·52
	12	79 Draconis...		"	51 28·86		31·44	.....	....		51 47·48
	13	Bradley 2897..		"	56 44·59		47·39	.....	....		57 03·43
	14	B.J. 833.......	r	"	22 05 00·08		00·60	16·65	16·05		22 05 16·64
	15	B.J. 835.......		"	05 45·04		45·62	01·69	16·07		06 01·66
	16	B.J. 837.......		"	07 49·74		52·11	.....	....		08 08·15
	17	1 H.Lacertae..		"	09 46·49		47·21	.....	....		10 03·25
	18	Bradley 2942..		"	11 00·11		02·61	.....	....		11 18·65
	19	B.A.C. 3495...	L.C.,nr	"	16 28·85		20·77	37·26	16·49		....
	20	30 H. Camel..	L.C.,nr	"	19 57·67		51·56	07·68	16·12		....
	21	B.D. 70·1240..		"	23 26·28		28·46	.....	....		23 44·50
	22	28 Cephei.....	r	"	25 46·92		50·88	.....	....		26 06·92
	23	B.J. 848.......		"	27 20·45		21·39	37·42	....		27 37·43
	24	29 Cephei.....		"	28 50·44		54·18	.....	....		29 10·22
	25	226 B. Cephei		"	30 26·77		29·81	.....	....		30 45·85
	26	B.J. 851.......		"	33 17·92		20·49	.....	....		33 36·53
	27	Groom. 3857..		"	35 02·47		05·33	.....	....		35 21·37
	28	B.J. 858.......	r	"	39 50·29		51·00	06·98	15·98	16·05	40 07·05
	29	B.J. 869.......		"	57 32·32		33·10	49·17	16·07		57 49·15
	30	5 Andromedae		"	23 03 25·67		26·58	.....	....		23 03 42·63
	31	B.J. 874.......	r	"	04 47·19		50·23	.....	....		05 06·28
	32	B.J. 875.......		"	08 42·41		43·60	59·66	....		08 59·65
	33	Bradley 3085..		"	11 10·23		12·89	.....	....		11 28·94
	34	Groom. 4033..		"	13 53·76		56·60	.....	....		14 12·65
	35	1 H. Cass.....		"	25 37·94		39·20	.....	....	16·06	25 55·26
Sept. 13	36	*b* Aquilae.....		S	19 20 26·74	·059	26·98	.....	....	15·66	19 20 42·64
	37	21 B. Vulp....		"	21 27·93	(·752)	28·37	.....	....		21 44·03
	38	4 Cygni.......		"	22 39·96		40·62	.....	....		22 56·28
	39	B.D. 76·734...		"	24 28·55		31·78	.....	....		24 47·44
	40	B.J. 734.......		"	26 50·69		54·86	.....	....		27 10·52
	41	B.D. 70·1073..		"	31 27·40		29·66	.....	....		31 45·32
	42	B.D. 49·3059..		"	33 16·27		17·22	.....	....		33 32·88
	43	B.J. 738.......		"	33 46·76		47·71	03·27	....		34 03·37
	44	14 Cygni......		"	36 15·89		16·70	.....	....		36 32·36
	45	10 Vulp.......		"	39 44·10		44·55	.....	....		40 00·21
	46	B.J. 740.......		"	40 47·26		47·94	03·56	15·62		41 03·60
	47	B.J. 743.......	r	"	43 08·43		08·72	24·37	15·65		43 24·38
	48	ζ Sagittae.....		"	44 44·81		45·15	.....	....		45 00·81
	49	ϕ Aquilae.....		"	51 44·59		44·82	.....	....		52 00·48

Clamp East. 1—35. Adopted $\Delta T+m=16{\cdot}033+{\cdot}0125\ (T-21^h\ 40^m)$.
36—49. Adopted $\Delta T+m=15{\cdot}647-{\cdot}0068\ (T-21^h\ 10^m)$.

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TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 13	1	B.J. 752		S	19 54 31·21	·059	31·55	47·20	15·65	15·66	19 54 47·21
	2	15 Vulp		"	57 09·36	(·752)	09·84	.....	....		57 25·50
	3	B.D. 69·1084		"	58 39·27		41·44	.....	....		58 57·10
	4	69 Draconis		"	20 01 51·85		55·04	.....	....	15·65	20 02 10·69
	5	b^2 Cygni		"	05 50·62		51·29	.....	....		06 06·94
	6	20 Vulp		"	08 00·00		00·46	.....	....		08 16·11
	7	ρ Aquilae		"	09 52·89		53·17	.....	....		10 08·82
	8	B.J. 759		"	11 39·22		42·73	.....	....		11 58·38
	9	B.J. 765		"	18 45·39		46·13	01·77	15·64		19 01·78
	10	40 Cygni		"	23 59·73		00·43	.....	....		24 16·08
	11	41 Cygni		"	25 28·90		29·44	.....	....		25 45·09
	12	ω^1 Cygni		"	27 01·60		02·52	.....	....		27 18·17
	13	B.J. 768		"	28 41·10		41·32	56·95	15·63		28 56·97
	14	Groom. 3241		"	30 08·28		10·73	.....	....		30 26·38
	15	B.J. 770		"	32 26·00		28·85	.....	....		32 44·50
	16	29 Vulp		"	34 16·20		16·58	.....	....		34 32·23
	17	B.J. 778		"	39 01·65		01·93	17·58	15·65		39 17·58
	18	B.J. 780	r	"	42 19·95		20·50	36·22	15·72		42 36·15
	19	B.J. 784		"	43 39·89		40·55	56·17	15·62		43 56·20
	20	76 Draconis	rn	"	48 51·58		57·44	13·13	15·69		....
	21	220 H[1]. Drac	rn	"	51 24·75		29·40	45·21	15·81		....
	22	B.J. 788		"	53 34·72		35·48	51·10	15·62		53 51·13
	23	Bradley 2748		"	55 32·66		35·70	.....	....		55 51·35
	24	B.J. 792		"	21 01 25·03		25·86	41·51	15·65		21 01 41·51
	25	f^2 Cygni		"	03 15·63		16·50	.....	....		03 32·15
	26	Groom. 3409		"	05 36·02		38·32	.....	....		05 53·97
	27	B.J. 795		"	07 02·77		06·37	.....	....		07 22·02
	28	B.J. 799		"	10 57·67		58·36	14·02	15·66		11 14·01
	29	σ Cygni		"	13 38·58		39·30	.....	....		13 54·95
	30	Bradley 2796		"	16 25·91		29·21	.....	....		16 44·86
	31	B.J. 804		"	17 41·65		41·99	57·69	15·70		17 57·64
	32	69 Cygni		"	21 52·16		52·82	.....	....		22 08·47
	33	1 H.Draconis	L.C.,rn	"	24 07·86		02·64	18·42	15·78		....
	34	B.J. 807		"	25 53·40		54·24	09·86	....		26 09·89
	35	72 Cygni		"	30 51·81		52·51	.....	....	15·64	31 08·15
	36	B.J. 817	r	"	40 21·26		23·53	.....	....		40 39·17
	37	78 Draconis		"	41 43·62		46·02	.....	....		42 01·66
	38	B.J. 821		"	43 13·83		14·75	30·35	....		43 30·39
	39	14 Pegasi		"	45 37·83		38·36	.....	....		45 54·00
	40	B.J. 823		"	48 44·16		44·61	00·29	15·68		49 00·25
	41	Bradley 2868		"	49 50·68		51·86	.....	....		50 07·50
	42	13 Cephei		"	51 37·24		38·43	.....	....		51 54·07
	43	B.J. 826		"	56 28·73		28·98	44·66	15·68		56 44·62
	44	16 Cephei		"	57 43·10		45·62	.....	....		58 01·26
	45	B.J. 831		"	22 02 35·50		35·94	51·58	15·64		22 02 51·58
	46	B.J. 833	r	"	05 00·45		00·98	16·64	15.66		05 16·62
	47	28 Pegasi		"	06 01·24		01·61	.....	....		06 17·25
	48	B.J. 837		"	07 50·01		52·41	.....	....		08 08·05
	49	1 H.Lacertae		"	09 46·84		47·57	.....	....		10 03·21
	50	Bradley 2942		"	11 00·40		02·95	.....	....		11 18·59

Clamp East. 1—50. Adopted $\Delta T+m=15\cdot647-\cdot0068\ (T-21^h\ 10^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.		s.	h. m. s.
Sept. 13	1	B.A.C. 3495...	L.C.,rn	S	22 16 29·93	·059	21·73	37·57	15·84	15·64	....
	2	30 H. Camel..	L.C.,rn	"	19 58·39	(·752)	52·19	07·90	15·71		....
	3	B.D. 70·1240..		"	23 26·53		28·74	....	....		22 23 44·30
	4	28 Cephei.....		"	25 47·43		51·21	....	....		26 06·85
	5	B.J. 848.......		"	27 20·82		21·77	37·40	....		27 37·41
	6	29 Cephei.....	r	"	28 50·42		54·44	....	....		29 10·08
	7	B.J. 851.......		"	33 18·27		20·87	....	....		33 36·51
	8	Groom. 3857..		"	35 02·64		05·55	....	....		35 21·19
	9	B.J. 855.......		"	36 45·02		45·24	00·87	15·63		37 00·88
	10	B.J. 857.......		"	38 33·14		33·67	49·33	15·66		38 49·31
Sept. 14	11	b Aquilae.....		N	19 20 26·93	·035	27·11	....	....	15·55	19 20 42·66
	12	21 B. Vulp....	r	"	21 28·10	(·735)	28·48	....	....		21 44·03
	13	4 Cygni.......		"	22 40·12		40·71	....	....		22 56·26
	14	α Vulp........		"	24 43·47		43·85	....	....		24 59·40
	15	B.J. 732.......		"	26 51·30		51·73	07·21	15·48		27 07·28
	16	8 Cygni.......		"	28 11·20		11·74	....	....		28 27·29
	17	B.D. 70·1073..		"	31 27·41		29·61	....	....		31 45·16
	18	B.D. 49·3059..		"	33 16·40		17·33	....	....		33 32·88
	19	B.J. 738.......		"	33 46·79		47·72	03·24	....		34 03·27
	20	β Sagittae.....		"	36 46·49		46·75	....	....		37 02·30
	21	10 Vulp.......		"	39 44·26		44·65	....	....		40 00·20
	22	B.J. 740.......		"	40 47·43		48·04	03·54	15·50		41 03·59
	23	ζ Sagittae....		"	44 45·01		45·29	....	....		45 00·84
	24	B.J. 747.......		"	48 12·76		14·87	....	....		48 30·42
	25	φ Aquilae.....		"	51 44·81		44·99	....	....		52 00·54
	26	B.J. 750.......		"	53 03·27		04·28	19·87	....		53 19·83
	27	B.J. 752.......		"	54 31·35		31·64	47·19	15·55		54 47·19
	28	15 Vulp.......		"	57 09·52		09·94	....	....		57 25·49
	29	B.D. 69.1084..		"	58 39·19		41·31	....	....		58 56·86
	30	69 Draconis...		"	20 01 52·07		55·19	....	....		20 02 10·74
	31	Groom. 1119..	L.C.,nr	"	08 55·25		17·83	36·44	18·61		....
	32	176 B. Cygni..		"	16 45·19		45·84	....	....		17 01·39
	33	B.J. 765.......	r	"	18 45·56		46·23	01·76	15·53	15·54	19 01·77
	34	40 Cygni......		"	23 59·84		00·47	....	....		24 16·01
	35	41 Cygni......		"	25 29·03		29·50	....	....		25 45·04
	36	ω¹ Cygni......		"	27 01·68		02·58	....	....		27 18·12
	37	B.J. 768.......		"	28 41·26		41·43	56·94	15·51		28 56·97
	38	ζ Delphini....	r	"	30 52·46		52·68	....	....		31 08·22
	39	B.J. 771.......		"	33 06·11		06·32	21·85	15·53		33 21·86
	40	29 Vulp.......		"	34 16·35		16·67	....	....		34 32·21
	41	B.J. 774.......		"	35 13·84		14·08	29·60	15·52		35 29·62
	42	B.J. 777.......		"	38 07·41		08·21	23·77	15·56		38 23·75
	43	B.J. 778.......		"	39 01·77		01·99	17·57	15·58		39 17·53
	44	B.J. 780.......		"	42 20·05		20·59	36·20	15·61		42 36·13
	45	B.J. 784.......	r	"	43 40·02		40·61	56·16	15·55		43 56·15
	46	76 Draconis..	nr	"	48 51·70		57·26	13·00	15·74		....
	47	220 H¹. Drac..		"	51 24·85		29·26	....	....		51 44·80
	48	B.J. 788.......		"	53 34·76		35·44	51·09	15·65		53 50·98
	49	f¹ Cygni......		"	56 31·51		32·36	....	....		56 47·90

Clamp East. 1—10. Adopted $\Delta T+m=15{\cdot}647-{\cdot}0068\ (T-21^{h}\ 10^{m})$.

11—49. Adopted $\Delta T+m=15{\cdot}542-{\cdot}0068\ (T-20^{h}\ 45^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE.—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
1910 Sept. 14	1	B.J. 792.......		N	21 01 25·10	·035	25·86	41·50	15·64	15·54	21 01 41·40
	2	B.J. 793.......		"	02 37·90	(·735)	38·53	54·04	15·51		02 54·07
	3	Groom. 3409..		"	05 36·01		38·26	.....	....		05 53·80
	4	B.J. 795.......		"	07 02·76		06·28	.....	....		07 21·82
	5	B.J. 798.......		"	09 16·00		17·33	33·01	....		09 32·87
	6	σ Cygni.......		"	13 38·68		39·33	.....	....		13 54·87
	7	B.J. 804.......		"	17 41·82		42·11	57·68	15·57		17 57·65
	8	69 Cygni......		"	21 52·29		52·88	.....	....		22 08·42
	9	1 H.Draconis..	L.C.,nr	"	24 07·92		02·99	18·54	15·55		....
	10	B.J. 807.......		"	25 53·45		54·27	09·85	....		26 09·81
	11	ρ Cygni.......		"	30 21·54		22·34	.....	....		30 37·88
	12	B.J. 811.......		"	33 06·40		07·07	22·65	15·58		33 22·61
	13	B.J. 813.......		"	35 55·56		56·77	12·43	....		36 12·31
	14	B.J. 817.......		"	40 21·41		23·62	.....	....		40 39·16
	15	78 Draconis...	r	"	41 43·52		45·87	.....	....		42 01·41
	16	B.J. 821.......		"	43 13·90		14·81	30·34	....		43 30·35
	17	14 Pegasi.....		"	45 38·03		38·49	.....	....		45 54·03
	18	B.J. 823.......		"	48 44·36		44·75	00·28	15·53	15·53	49·00·28
	19	Bradley 2868..		"	49 50·71		51·86	.....	....		50 07·39
	20	13 Cephei.....	r	"	51 37·30		38·47	.....	....		51 54·00
	21	B.J. 826.......		"	56 28·94		29·14	44·66	15·52		56 44·67
	22	16 Cephei.....		"	57 43·14		45·61	.....	....		58 01·14
	23	B.J. 831.......		"	22 02 35·64		36·02	51·57	15·55		22 02 51·55
	24	B.J. 833.......	r	"	05 00·57		01·09	16·64	15·55		05 16·62
	25	B.J. 835.......		"	05 45·60		46·12	01·67	15·55		06 01·65
	26	B.J. 837.......		"	07 50·19		52·54	.....	....		08 08·07
	27	1 H.Lacertae..		"	09 46·98		47·63	.....	....		10 03·16
	28	Bradley 2942..		"	11 00·44		02·92	.....	....		11 18·45
	29	B.A.C. 3495...	L.C.,nr	"	16 29·85		22·09	37·70	15·61		....
	30	30 H. Camel..	L.C.	"	19 58·55		52·69	08·00	15·31		....
Sept. 15	31	10 Vulp.......		S	19 39 44·34	.048	44·78	.....	....	15·35	19 40 00·13
	32	B.J. 740.......		"	40 47·50	(·746)	48·17	03·53	15·36		41 03·52
	33	B.J. 742.......		"	41 55·18		56·04	11·37	15·33		42 11·39
	34	B.J. 743.......		"	43 08·71		09·03	24·34	15·31		43 24·38
	35	ζ Sagittae....	r	"	44 45·21		45·48	.....	....		45 00·83
	36	φ Aquilae.....		"	51 44·96		45·18	.....	....		52 00·53
	37	B.J. 750.......		"	53 03·50		04·51	19·85	....	15·34	53 19·85
	38	B.J. 752.......		"	54 31·54		31·87	47·17	15·30		54 47·21
	39	15 Vulp.......		"	57 09·68		10·15	.....	....		57 25·49
	40	B.D. 69·1084..		"	58 39·50		41·62	.....	....		58 56·96
	41	69 Draconis...		"	20 01 52·07		55·19	.....	....		20 02 10·53
	42	b^2 Cygni......		"	05 50·87		51·52	.....	....		06 06·86
	43	20 Vulp.......		"	08 00·35		00·80	.....	....		08 16·14
	44	ρ Aquilae.....		"	09 53·16		53·43	.....	....		10 08·77
	45	B.J. 759.......		"	11 39·37		42·80	.....	....		11 58·14
	46	B.J. 760.......		"	12 42·15		42·57	57·96	15·39		12 57·91
	47	B.J. 765.......	r	"	18 45·72		46·39	01·74	15·35		19 01·73
	48	40 Cygni......	r	"	24 00·11		00·74	.....	....		24 16·08
	49	41 Cygni......		"	25 29·15		29·67	.....	....		25 45·01

Clamp East. 1—30. Adopted $\Delta T+m=15{\cdot}542-{\cdot}0068\ (T-20^h\ 45^m)$.
31—49. Adopted $\Delta T+m=15{\cdot}335-{\cdot}0068\ (T-21^h\ 20^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 15	1	ω^1 Cygni.....		S	20 27 01.91	·048	02·80	.....	....	15·34	20 27 18·14
	2	B.J. 768.......		"	28 41·39	(·746)	41·60	56·93	15·33		28 56·94
	3	ζ Delphini.....		"	30 52·56		52·82	.....	....		31 08·16
	4	B.J. 770.......		"	32 26·45		29·24	.....	....		32 44·58
	5	B.J. 774.......		"	35 13·98		14·26	29·59	15·33		35 29·60
	6	B.J. 778.......		"	39 01·94		02·20	17·56	15·36		39 17·54
	7	B.J. 782.......		"	42 52·52		53·73	09·10	....		43 09·07
	8	76 Draconis...	nr	"	48 51·68		57·42	12·86	15·44		....
	9	220 H[1]. Drac..	nr	"	51 25·04		29.60	45·03	15·43		....
	10	B.J. 788.......		"	53 34·96		35·70	51·07	15·37		53 51·04
	11	Bradley 2748..		"	55 32·95		35.92	.....	....		55 51·26
	12	Groom. 3409..		"	21 05 36·24		38·48	.....	....		21 05 53 82
	13	B.J. 795.......		"	07 03·02		06·54	.....	....		07 21·88
	14	B.J. 798.......		"	09 16·23		17·56	32·99	....		09 32·90
	15	B.J. 799.......		"	10 58·00		58·67	14·00	15·33		11 14·01
	16	ν Cygni.......		"	13 59·20		59·80	.....	....		14 15·14
	17	B.A.C. 7504..	nr	"	17 16·98		30.45	45·93	15·48		....
	18	69 Cygni......		"	21 52·47		53·10	.....	....	15·33	22 08·43
	19	1 H. Draconis	L.C.,nr	"	24 08·08		02·98	18·66	15·68		....
	20	B.J. 809.......		"	27 15·34		17·47	.....	....		27 32·80
	21	B.J. 811.......		"	33 06·58		07·31	22·65	15·34		33 22·64
	22	B.J. 813.......		"	35 55·89		57·09	12·42	....		36 12·42
	23	B.J. 817.......	r	"	40 21·52		23·89	.....	....		40 39·22
	24	78 Draconis...		"	41 43·86		46·20	.....	....		42 01·53
	25	B.J. 821.......		"	43 14·10		15·00	30·33	....		43 30·33
	26	14 Pegasi.....		"	45 38·13		38·65	.....	....		45 53·98
	27	B.J. 823.......		"	48 44·51		44·95	00·28	15·33		49 00·28
	28	Bradley 2868..		"	49 50.94		52·09	.....	....		50 07·42
	29	13 Cephei.....		"	51 37·47		38·63	.....	....		51 53·96
	30	B.J. 826.......		"	56 29·03		29·27	44·66	15·39		56 44·60
	31	16 Cephei.....	r	"	57 43·23		45·85	.....	....		58 01·18
	32	B.J. 831.......		"	22 02 35·84		36·26	51·57	15·31		22 02 51·59
	33	B.J. 833.......		"	05 00 69		01·26	16·64	15·38		05 16·59
	34	28 Pegasi.....		"	06 01·54		01·89	.....	....		06 17·22
	35	B.J. 837.......		"	07 50·29		52·63	.....	....		08 07·96
	36	1 H.Lacertae..		"	09 47·11		47.82	.....	....		10 03·15
	37	Bradley 2942..		"	11 00·59		03·08	.....	....		11 18·41
	38	B.A.C. 3495...	L.C.,nr	"	16 30·58		22·56	37·83	15·27		....
	39	30 H. Camel..	L.C.,nr	"	19 58·77		52·71	08·11	15·40.		....
	40	B.D. 70·1240..		"	23 26·80		28·95	.....	....		23 44·28
	41	28 Cephei.....		"	25 47·68		51·37	.....	....		26 06·70
	42	B.J. 848.......		"	27 21·08		22·00	37·40	....		27 37·33
	43	29 Cephei.....	r	"	28 50·66		54·60	.....	....		29 09·93
	44	B.J. 851.......		"	33 18·51		21·05	.....	....		33 36·38
	45	Groom. 3857..		"	35 02.91		05·75	.....	....		35 21·08
	46	B.J. 855.......		"	36 45·30		45·50	00·88	15·38		37 00·83
	47	B.J. 857.......		"	38 33·46		33·98	49·33	15·35		38 49·31
	48	B.J. 858.......		"	39 50·84		51·60	06·98	15·38		40 06.93
	49	B.J. 859.......		"	41 58·41		58·81	14·13	15·32		42 14·14
	50	B.J. 862.......	r	"	45 26·22		26·59	41.94	15·35		45 41·92

Clamp East. 1—50. Adopted $\Delta T+m=15{\cdot}335-{\cdot}0068\ (T-21^h\ 20^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 15	1	52 Pegasi.....		S	22 54 28·61	·048	28·83	.....	....	15.32	22 54 44·15
	2	B.J. 869.......	r	"	57 33·15	(·746)	33·86	49·18	15·32		57 49·18
	3	B.J. 870.......		"	59 11·28		11·75	27·04	15·29		59 27·07
	4	5 Andromedae		"	23 03 26·33		27·22	.....	....		23 03 42·54
	5	B.J. 874.......		"	04 47·91		50·75	.....	....		05 06·07
	6	B.J. 875.......		"	08 43·14		44·32	59·67	....		08 59·64
Sept. 16	7	λ Urs. Min....		N	19 09 56·96	−·038	36·73	50·32	13·59	15·17	....
	8	B.J. 726.......		"	14 46·69	(·704)	47·57	02·76	....		19 15 02·74
	9	b Aquilae.....		"	20 27·21		27·34	.....	....		20 42·51
	10	21 B. Vulp....	r	"	21 28·51		28·80	.....	....		21 43·97
	11	4 Cygni.......		"	22 40·56		41·03	.....	....		22 56·20
	12	α Vulp........		"	24 43·81		44·10	.....	....		24 59·27
	13	B.J. 733.......		"	27 11·67		12·51	27·69	....		27 27·68
	14	8 Cygni.......		"	28 11·64		12·08	.....	....		28 27·25
	15	B.D. 49·3059..	r	"	33 16·82		17·61	.....	....		33 32·78
	16	B.J. 738.......		"	33 47·25		48·04	03·19	....		34 03·21
	17	β Sagittae....		"	36 46·88		47·08	.....	....		37 02·25
	18	10 Vulp.......		"	39 44·66		44·97	.....	....		40 00·14
	19	B.J. 740.......		"	40 47·89		48·39	03·51	15·12		41 03·56
	20	B.J. 742.......		"	41 55·48		56·13	11·35	15·22		42 11·30
	21	B.J. 743.......	r	"	43 08·97		09·18	24·33	15·15		43 24·35
	22	ζ Sagittae.....		"	44 45·39		45·61	.....	....		45 00·78
	23	φ Aquilae.....		"	51 45·17		45·29	.....	....		52 00·46
	24	B.J. 750.......		"	53 03·83		04·69	19·82	....		53 19·86
	25	B.J. 752.......		"	54 31·85		32·08	47·16	15·08	15·16	54 47·24
	26	b² Cygni......		"	20 05 51·18		51·66	.....	....		20 06 06·82
	27	20 Vulp.......		"	08 00·65		00·97	.....	....		08 16·13
	28	B.J. 757.......		"	10 33·82		34·51	49·63	....		10 49·67
	29	B.J. 760.......		"	12 42·38		42·67	57·95	15·28		12 57·83
	30	176 B. Cygni..		"	16 45·65		46·18	.....	....		17 01·34
	31	B.J. 765.......	r	"	18 45·93		46·48	01·72	15·24		19 01·64
	32	40 Cygni......		"	24 00·43		00·95	.....	....		24 16·11
	33	41 Cygni......		"	25 29·47		29·85	.....	....		25 45·01
	34	ω¹ Cygni......		"	27 02·27		03·02	.....	....		27 18·18
	35	B.J. 768.......		"	28 41·66		41·77	56·92	15·15		28 56·93
	36	ζ Delphini.....	r	"	30 52·82		52·98	.....	....		31 08·14
	37	B.J. 771.......		"	33 06·45		06·61	21·83	15·22		33 21·77
	38	29 Vulp.......		"	34 16·80		17·04	.....	....		34 32·20
	39	B.J. 774.......		"	35 14·26		14·44	29·58	15·14		35 29·60
	40	B.J. 777.......		"	38 07·85		08·50	23·73	15·23		38 23·66
	41	B.J. 778.......		"	39 02·21		02·37	17·55	15·18		39 17·53
	42	B.J. 780.......	r	"	42 20·52		20·95	36·18	15·23		42 36·11
	43	B.J. 784.......		"	43 40·53		41·00	56·13	15·13		43 56·16
	44	76 Draconis...	nr	"	48 52·60		57·59	12·73	15·14		....
	45	220 H¹.Drac...		"	51 26·09		30·04	.....	....		51 45·20
	46	B.J. 788.......		"	53 35·30		35·87	51·06	15·19		53 51·03
	47	f¹ Cygni......		"	56 32·02		32·73	.....	....		56 47·89
	48	B.J. 792.......		"	21 01 25·65		26·27	41·47	15·20		21 01 41·43
	49	B.J. 793.......		"	02 38·34		38·86	54·02	15·16		02 54·02

From Sept. 15 Clamp East; from Sept. 16 Clamp West.
1—6. Adopted $\Delta T+m=15{\cdot}335-{\cdot}0068\ (T-21^h\ 20^m)$.
7—49. Adopted $\Delta T+m=15{\cdot}158-{\cdot}0068\ (T-20^h\ 55^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 16	1	B.J. 797.......		N	21 08 52·95	– ·038	53·32	08·45	15·13	15·16	21 09 08·48
	2	B.J. 799.......		"	10 58·32	(·704)	58·82	13·99	15·17		11 13·98
	3	σ Cygni......		"	13 39·24		39·77	.....	....		13 54·93
	4	B.J. 804.......		"	17 42·31		42·53	57·67	15·14		17 57·69
	5	69 Cygni......		"	21 52·94		53·41	.....	....	15·15	22 08·56
	6	1 H. Draconis	L.C.,rn	"	24 07·91		03·45	18·78	15·33.		....
	7	72 Cygni......		"	30 52·47		52·99	.....	....		31 08·14
	8	B.J. 811.......		"	33 06·92		07·47	22·64	15·17		33 22·62
	9	B.J. 813.......		"	35 56·25		57·28	12·40	......		36 12·43
	10	B.J. 816.......	r	"	40 21·02		21·32	36·40	15·08		40 36·47
	11	B.J. 821.......		"	43 14·35		15·11	30·32	....		43 30·26
	12	14 Pegasi.....		"	45 38·47		38·84	.....	....		45 53·99
	13	B.J. 823.......		"	48 44·84		45·15	00·27	15·12		49 00·30
	14	Bradley 2868..		"	49 51·24		52·22	...	....		50 07·37
	15	13 Cephei.....		"	51 37·85		38·84	.....	....		51 53·99
	16	B.J. 826.......		"	56 29·35		29·49	44·65	15·16		56 44·64
	17	B.J. 831.......		"	22 02 36·18		36·47	51·57	15·10		22 02 51·62
	18	B.J. 833.......	r	"	05 00·96		01·37	16·63	15·26		05 16·52
	19	B.J. 835.......		"	05 46·15		46·56	01·66	15·10		06 01·71
	20	B.J. 836.......		"	07 30·22		31·27	46·34	....		07 46·42
	21	1 H.Lacertae..		"	09 47·49		48·03	.....	....		10 03·18
	22	B.A.C. 3495...	L.C.,nr	"	16 29·66		22·66	37·98	15·32		....
	23	30 H. Camel..	L.C.,nr	"	19 58·95		53·64	08·21	14·57		....
Sept. 17	24	B.D. 76·734...		S	19 24 29·41	– ·048	32·16	.....	.....	15·16	19 24 47·32
	25	B.J. 734.......		"	26 51·53	(·723)	55·10	.....	....		27 10·26
	26	8 Cygni.......		"	28 11·65		12·12	.....	....		28 27·28
	27	B.D. 70·1073..		"	31 28·00		29·89	.....	......		31 45·05
	28	B.D. 49·3059..		"	33 16·85		17·61	.....	....		33 32·77
	29	B.J. 738.......	r	"	33 47·14		47·97	03·16	......		34 03·13
	30	β Sagittae.....		"	36 46·82		47·03	.....	....		37 02·19
	31	10 Vulp.......		"	39 44·64		44·97	.....	....		40 00·13
	32	B.J. 740.......		"	40 47·83		48·36	03·49	15·13		41 03·52
	33	B.J. 742.......		"	41 55·43		56·12	11·32	15·20		42 11·28
	34	B.J. 743.......	r	"	43 08·98		09·16	24·32	15·16		43 24·32
	35	ζ Sagittae.....		"	44 45·37		45·61	.....	....		45 00·77
	36	φ Aquilae.....		"	51 45·21		45·34	.....	....	15·15	52 00·49
	37	B.J. 750.......		"	53 03·86		04·68	19·79	....		53 19·83
	38	B.J. 752.......		"	54 31·74		31·98	47·15	15·17		54 47·13
	39	15 Vulp.......		"	57 09·95		10·31	.....	....		57 25·46
	40	B.D. 69·1084..		"	58 39·96		41·77	.....	....		58 56·92
	41	69 Draconis...		"	20 01 52·67		55·38	.....	....		20 02 10·53
	42	b^2 Cygni......		"	05 51·16		51·67	.....	....		06 06·82
	43	20 Vulp.......		"	08 00·65		00·98	.....	....		08 16·13
	44	ρ Aquilae.....		"	09 53·41		53·60	.....	....		10 08·75
	45	B.J. 759.......		"	11 39·91		42·90	.....	....		11 58·05
	46	B.J. 765.......		"	18 45·97		46·56	01·70	15·14		19 01·71
	47	40 Cygni......		"	20 00·42		00·97	.....	....		20 16·12
	48	41 Cygni......		"	25 29·43		29·83	.....	....		25 44·98

Clamp West. 1–23. Adopted $\Delta T+m=15{\cdot}158-{\cdot}0068\ (T-20^{h}\ 55^{m})$.
24–48. Adopted $\Delta T+m=15{\cdot}149-{\cdot}0068\ (T-20^{h}\ 40^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 17	1	ω¹ Cygni		S	20 27 02·28	−·048	03·00			15·15	20 27 18·15
	2	B.J. 768		"	28 41·63	(·723)	41·76	56·91	15·15		28 56·91
	3	ζ Delphini		"	30 52·79		52·97				31 08·12
	4	B.J. 770		"	32 26·89		29·30				32 44·45
	5	29 Vulp		"	34 16·73		16·99				34 32·14
	6	B.J. 774		"	35 14·21		14·40	29·57	15·17		35 29·55
	7	B.J. 778		"	39 02·19		02·37	17·54	15·17		39 17·52
	8	B.J. 782		"	42 52·94		53·94	09·05			43 09·09
	9	76 Draconis	rn	"	48 52·45		57·50	12·61	15·11		
	10	220 H¹. Drac	rn	"	51 25·65		29·65	44·85	15·20		
	11	B.J. 788		"	53 35·31		35·90	51·05	15·15		53 51·05
	12	f¹ Cygni		"	56 32·10		32·78				56 47·93
	13	B.J. 792		"	21 01 25·58		26·24	41·45	15·21		21 01 41·39
	14	f² Cygni		"	03 16·29		16·97				03 32·12
	15	Groom. 3409		"	05 36·63		38·56				05 53·71
	16	B.J. 795		"	07 03·65		06·72				07 21·87
	17	B.J. 797		"	08 52·90		53·29	08·44	15·15		09 08·44
	18	B.J. 799		"	10 58·31		58·85	13·97	15·12		11 14·00
	19	υ Cygni		"	13 59·48		59·96				14 15·11
	20	69 Cygni		"	21 52·84		53·35			15·14	22 08·49
	21	72 Cygni		"	30 52·46		53·01				31 08·15
	22	B.J. 811		"	33 06·88		07·47	22·63	15·16		33 22·61
	23	B.J. 813		"	35 56·21		57·20	12·38			36 12·34
	24	B.J. 816	r	"	40 20·97		21·24	36·40	15·16		40 36·38
Sept. 19	25	α Vulp		N	19 24 44·38	−·040	44·66			14·61	19 24 59·27
	26	B.J. 732		"	26 52·15	(·678)	52·48	07·12	14·64		27 07·09
	27	8 Cygni		"	28 12·13		12·55				28 27·16
	28	B.D. 49·3059		"	33 17·24		18·00				33 32·61
	29	B.J. 738	r	"	33 47·71		48·47	03·10			34 03·08
	30	14 Cygni		"	36 17·01		17·58			14·60	36 32·18
	31	10 Vulp		"	39 45·25		45·55				40 00·15
	32	B.J. 740		"	40 48·35		48·83	03·44	14·61		41 03·43
	33	B.J. 742		"	41 55·96		56·59	11·27	14·68		42 11·19
	34	B.J. 743		"	43 09·53		09·72	24·28	14·56		43 24·32
	35	ζ Sagittae	r	"	44 45·91		46·11				45 00·71
	36	φ Aquilae		"	51 45·83		45·95				52 00·55
	37	B.J. 750		"	53 04·32		05·13	19·73			53 19·73
	38	B.J. 752		"	54 32·30		32·51	47·11	14·60		54 47·11
	39	15 Vulp		"	57 10·52		10·84				57 25·44
	40	Groom. 1119	L.C.,rn	"	20 08 58·48		26·22	42·05	15·83		
	41	176 B. Cygni		"	16 46·17		46·68				20 17 01·28
	42	B.J. 765		"	18 46·55		47·08	01·66	14·58		19 01·68
	43	40 Cygni		"	24 00·94		01·44				24 16·04
	44	41 Cygni		"	25 30·04		30·39				25 44·99
	45	ω¹ Cygni		"	27 02·72		03·44				27 18·04
	46	B.J. 768		"	28 42·15		42·26	56·88	14·62		28 56·86
	47	ζ Delphini		"	30 53·38		53·54				31 08·14
	48	B.J. 771	r	"	33 07·04		07·19	21·79	14·60		33 21·79
	49	29 Vulp		"	34 17·36		17·59				34 32·19

Clamp West. 1—24. Adopted $\Delta T+m=15\cdot149-\cdot0068$ (T$-20^h\ 40^m$).
25—49. Adopted $\Delta T+m=14\cdot597-\cdot0068$ (T$-20^h\ 45^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
					h. m. s.	s.	s.	s.	.	s.	h. m. s.
1910 Sept. 19	1	B.J. 774.......		N	20 35 14·75	—·040	14·92	29·54	14·62	14·60	20 35 29·52
	2	B.J. 777.......		"	38 08·40	(·678)	09·03	23·67	14·64		38 23·63
	3	B.J. 778.......		"	39 02·79		02·95	17·52	14·57		39 17·55
	4	B.J. 780.......		"	42 21·10		21·51	36·13	14·62		42 36·11
	5	B.J. 784.......	r	"	43 41·02		41·47	56·08	14·61		43 56·07
	6	76 Draconis...	rn	"	48 52·87		57·65	12·37	14·72		....
	7	220 H¹. Drac..		"	51 26·04		29·83	.....	....		51 44·43
	8	B.J. 788.......		"	53 35·82		36·36	51·01	14·65		53 50·96
	9	f^1 Cygni......		"	56 32·49		33·17	.....	....	.	56 47·77
	10	B.J. 792.......		"	21 01 26·20		26·79	41·42	14·63		21 01 41·39
	11	B.J. 793.......		"	02 38·90		39·40	53·98	14·58	14·59	02 53·99
	12	B.J. 798.......		"	09 17·17		18·26	32·89	....		09 32·85
	13	B.J. 799.......		"	10 58·89		59·37	13·94	14·57		11 13·96
	14	v Cygni.......		"	14 00·10		00·53	....	....		14 15·12
	15	B.J. 804.......		"	17 42·85		43·06	57·64	14·58		17 57·65
	16	69 Cygni......	r	"	21 53·33		53·78	.....	....		22 08·37
	17	1 H.Draconis..	L.C.,nr	"	24 08·91		04·64	19·10	14·46		.... .
	18	B.J. 807.......		"	25 54·55		55·23	09·78	....		26 09·82
	19	72 Cygni......		"	30 52·99		53·49	.....	....		31 08·06
	20	B.J. 811.......		"	33 07·50		08·03	22·60	14·57		33 22·62
	21	B.J. 813.......		"	35 56·68		57·66	12·34	....		36 12·25
	22	B.J. 816.......		"	40 21·47		21·76	36·38	14·62.		40 36·35
	23	B.J. 821.......		"	43 15·05		15·78	30·28	....		43 30·37
	24	14 Pegasi.....		"	45 39·02		39·38	.....	....		45 53·97
	25	B.J. 823.......	r	"	48 45·35		45·65	00·25	14·60		49 00·24
	26	Bradley 2868..		"	49 51·86		52·80	.....	....		50 07·39
	27	13 Cephei.....	r	"	51 38·37		39·32	.....	....		51 53·91
	28	B.J. 826.......		"	56 29·94		30·08	44·64	14·56		56 44·67
	29	B.J. 831.......		"	22 01 36·64		36·92	51·55	14·63		22 01 51·51
	30	B.J. 833.......		"	05 01·58		01·97	16·61	14·64		05 16·56
	31	B.J. 835.......	r	"	05 46·68		47·07	01·64	14·57		06 01·66
	32	B.J. 836.......		"	07 30·70		31·71	46·29	....		07 46·30
	33	1 H. Lacertae..		"	09 47·98		48·50	.....	....		10 03·09
	34	B.A.C. 3495...	L.C.,rn	"	16 30·28		23·58	38·34	14·76		....
Sept. 21	35	B.J. 768.......		N	20 28 42·42	—·048	42·52	56·85	14·33	14·34	20 28 56·86
	36	ζ Delphini.....	r	"	30 53·62	(·666)	53·76	.....	....		31 08·10
	37	B.J. 771.......		"	33 07·35		07·49	21·76	14·27		33 21·83
	38	29 Vulp.......		"	34 17·57		17·78	.....	....		34 32·12
	39	B.J. 774.......		"	35 15·04		15·20	29·51	14·31		35 29·54
	40	B.J. 777.......		"	38 08·71		09·32	23·63	14·31		38 23·66
	41	B.J. 778.......		"	39 03·05		03·19	17·49	14·30		39 17·53
	42	B.J. 780.......	r	"	42 21·33		21·73	36·10	14·37		42 36·07
	43	B.J. 784.......		"	43 41·30		41·74	56·05	14·31		43 56·08
	44	76 Draconis...	nr	"	48 53·07		57·70	12·14	14·44	14·33	....
	45	220 H¹. Drac..		"	51 26·69		30·36	.....	....		51 44·69
	46	B.J. 788.......		"	53 36·19		36·70	50·98	14·28		53 51·03
	47	f^1 Cygni......		"	56 32·94		33·60	.....	....		56 47·93
	48	Groom. 3409..		"	21 05 37·39		39·22	.....	....		21 05 53·55
	49	B.J. 798.......		"	09 17·48		18·54	32·84	....		09 32·87

Clamp West. 1—34. Adopted $\Delta T+m=14\cdot597-\cdot0068$ (T$-20^h\ 45^m$).
35—49. Adopted $\Delta T+m=14\cdot327-\cdot0068$ (T$-21^h\ 55^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T + m$	Adopted $\Delta T + m$	App.R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 21	1	B.J. 799.......		N	21 10 59·11	—·048	59·57	13·91	14·34	14·33	21 11 13·90
	2	σ Cygni.......		"	13 40·02	(·666)	40·51	.....	....		13 54·84
	3	Bradley 2796..		"	16 27·48		30·13	.....	....		16 44·46
	4	B.J. 804.......		"	17 43·08		43·27	57·62	14·35		17 57·60
	5	69 Cygni......	r	"	21 53·66		54·10	.....	....		22 08·43
	6	1 H. Draconis.	L.C.,nr	"	24 08·86		04·73	19·31	14·58		....
	7	B.J. 807.......		"	25 54·75		55·41	09·75	....		26 09·74
	8	B.J. 809.......		"	27 16·52		18·25	.....	....		27 32·58
	9	ρ Cygni......		"	30 22·94		23·55	.....	....		30 37·88
	10	B.J. 811.......		"	33 07·79		08·29	22·57	14·28		33 22·62
	11	B.J. 813.......		"	35 56·99		57·94	12·30	....		36 12·27
	12	B.J. 817.......	r	"	40 22·87		24·68	.....	....		40 39·01
	13	78 Draconis...		"	41 45·17		47·09	.....	....		42 01·42
	14	B.J. 821.......		"	43 15·24		15·94	30·25	....		43 30·27
	15	14 Pegasi.....		"	45 39·29		39·63	.....	....		45 53·96
	16	B.J. 823.......		"	48 45·64		45·92	00·24	14·32		49 00·25
	17	Bradley 2868..	r	"	49 52·09		53·00	.....	....		50 07·33
	18	13 Cephei.....		"	51 38·68		39·59	.....	....		51 53·92
	19	B.J. 826.......		"	56 30·17		30·29	44·63	14·34		56 44·62
	20	B.J. 831.......		"	22 02 36·93		37·20	51·54	14·34		22 02 51·53
	21	B.J. 833.......	r	"	05 01·81		02·19	16·60	14·41		05 16·52
	22	B.J. 835.......		"	05 46·87		47·25	01·63	14·38		06 01·58
	23	1 H. Lacertae		"	09 48·31		48·81	.....	....		10 03·14
	24	Bradley 2942..		"	11 01·83		03·87	.....	....		11 18·20
	25	B.A.C. 3495...	L.C.	"	16 30·69		24·19	38·54	14·35	14·32	....
	26	30 H. Camel..	L.C.,nr	"	19 59·66		54·76	08·63	13·87		....
	27	B.D. 70.1240...		"	23 27·98		29·73	.....	....		22 23 44·05
	28	B.J. 847.......		"	25 36·74		37·73	52·19	....		25 52·05
	29	B.J. 848.......		"	27 22·22		22·94	37·35	....		27 37·26
	30	29 Cephei.....		"	28 52·21		55·30	.....	....		29 09·62
	31	B.J. 851.......		"	33 19·67		21·75	.....	....		33 36·07
	32	B.J. 852.......		"	35 00·75		01·23	15·67	14·44		35 15·55
	33	B.J. 855.......		"	36 46·49		46·58	00·87	14·29		37 00·90
	34	B.J. 857.......		"	38 34·65		34·99	49·32	14·33		38 49·31
	35	B.J. 858.......		"	39 52·05		52·58	06·96	14·38		40 06·90
	36	B.J. 859.......	r	"	41 59·56		59·81	14·12	14·31		42 14·13
	37	B.J. 862.......		"	45 27·33		27·59	41·93	14·34		45 41·91
	38	52 Pegasi.....	r	"	54 29·71		29·81	.....	....		54 44·13
	39	B.J. 869.......	r	"	57 34·20		34·74	49·17	14·43		57 49·06
	40	B.J. 870.......		"	59 12·38		12·69	27·05	14·36		59 27·01
	41	B.J. 871.......		"	23 00 04·65		04·79	19·11	14·32		23 00 19·11
	42	5 Andromedae		"	03 27·52		28·21	.....	....		03 42·53
	43	B.J. 874.......		"	04 49·20		51·54	.....	....		05 05·86
	44	B.J. 875.......		"	08 44·31		45·24	59·66	....		08 59·56
	45	Bradley 3085..		"	11 12·21		14·37	.....	....		11 28·69
	46	Groom. 4033..		"	13 55·73		58·05	.....	....		14 12·37
	47	B.J. 880.......		"	15 58·81		59·06	13·35	14·29		16 13·38
	48	B.J. 881.......		"	20 41·11		41·35	55·67	14·32		20 55·67
	49	39 H. Cephei..	nr	"	27 35·56		47·02	00·72	13·70		....

Clamp West. 1—49. Adopted $\Delta T + m = 14{\cdot}327 - {\cdot}0068\ (T - 21^h\ 55^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 22	1	β Sagittae		S	19 36 47·82	—·053	48·04	.....	.....	14·12	19 37 02·16
	2	10 Vulp		"	39 45·57	(·751)	45·91	.....	.....		40 00·03
	3	B.J. 740		"	40 48·74		49·28	03·38	14·10		41 03·40
	4	B.J. 742		"	41 56·35		57·06	11·20	14·14		42 11·18
	5	B.J. 743		"	43 09·89		10·12	24·23	14·11		43 24·24
	6	ζ Sagittae	r	"	44 46·38		46·58	.....	.....		45 00·70
	7	φ Aquilae		"	51 46·16		46·30	.....	.....		52 00·42
	8	B.J. 750		"	53 04·68		05·53	19·64	.....		53 19·65
	9	B.J. 752		"	54 32·73		32·97	47·07	14·10		54 47·09
	10	15 Vulp		"	57 10·93		11·30	.....	.....		57 25·42
	11	Groom. 1119	L.C.,nr	"	20 09 05·41		29·97	45·09	15·12		.....
	12	B.J. 765		"	18 46·85		47·45	01·60	14·15		20 19 01·57
	13	40 Cygni	r	"	24 01·35		01·85	.....	.....		24 15·97
	14	41 Cygni		"	25 30·37		30·79	.....	.....		25 44·91
	15	ω¹ Cygni		"	27 03·11		03·86	.....	.....		27 17·98
	16	B.J. 768		"	28 42·56		42·69	56·84	14·15		28 56·81
	17	ζ Delphini		"	30 53·73		53·92	.....	.....		31 08·04
	18	B.J. 771	r	"	33 07·51		07·64	21·75	14·11		33 21·76
	19	29 Vulp		"	34 17·72		17·99	.....	.....		34 32·11
	20	B.J. 774		"	35 15·17		15·37	29·50	14·13		35 29·49
	21	B.J. 777		"	38 08·75		09·46	23·61	14·15		38 23·58
	22	B.J. 778		"	39 03·16		03·35	17·48	14·13		39 17·47
	23	B.J. 780		"	42 21·47		21·94	36·09	14·15		42 36·06
	24	B.J. 784	r	"	43 41·46		41·92	56·04	14·12		43 56·04
	25	76 Draconis	nr	"	48 52·62		57·83	12·02	14·19		.....
	26	220 H¹.Drac	nr	"	51 26·09		30·23	44·32	14·09		.....
	27	B.J. 788		"	53 36·21		36·83	50·96	14·13	14·11	53 50·94
	28	f¹ Cygni		"	56 32·98		33·69	.....	.....		56 47·80
	29	B.J. 792		"	21 01 26·52		27·20	41·36	14·16		21 01 41·31
	30	f² Cygni		"	03 17·20		17·91	.....	.....		03 32·02
	31	B.J. 797		"	08 53·82		54·23	08·37	14·14		09 08·34
	32	B.J. 799		"	10 59·24		59·79	13·90	14·11		11 13·90
	33	σ Cygni		"	13 40·15		40·73	.....	.....		13 54·84
	34	B.J. 804		"	17 43·23		43·47	57·61	14·14		17 57·58
	35	69 Cygni	r	"	21 53·85		54·31	.....	.....		22 08·42
	36	1 H. Draconis	L.C.,nr	"	24 09·92		05·24	19·41	14·17		.....
	37	B.J. 807		"	25 54·93		55·61	09·74	.....		26 09·72
	38	ρ Cygni		"	30 22·93		23·65	.....	.....		30 37·76
	39	B.J. 811		"	33 07·85		08·45	22·56	14·11		33 22·56
	40	B.J. 813		"	35 57·13		58·16	12·28	.....		36 12·27
	41	B.J. 816		"	40 21·93		22·26	36·35	14·09		40 36·37
	42	B.J. 821		"	43 15·39		16·14	30·23	.....		43 30·25
	43	14 Pegasi		"	45 39·43		39·84	.....	.....		45 53·95
	44	B.J. 823	r	"	48 45·84		46·13	00·23	14·10		49 00·24
	45	Bradley 2868		"	49 52·24		53·22	.....	.....		50 07·33
	46	13 Cephei	r	"	51 38·70		39·78	.....	.....		51 53·89
	47	B.J. 826		"	56 30·31		30·47	44·62	14·15		56 44·58
	48	B.J. 831		"	22 02 37·08		37·41	51·54	14·13		22 02 51·52
	49	B.J. 833		"	05 01·99		02·44	16·59	14·15		05 16·55
	50	B.J. 835	r	"	05 47·21		47·61	01·62	14·01		06 01·72

Clamp West. 1—50. Adopted $\Delta T+m=14{\cdot}112-{\cdot}0068$ (T—21^h 20^m).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 22	1	B.J. 836.......		S	22 07 31·09	−·053	32·15	46·24	....	14·11	22 07 46·26
	2	1 H.Lacertae..		"	09 48·49	(·751)	49·08	.....	....		10 03·19
	3	B.A.C. 3495...	L.C.,nr	"	16 32·02		24·67	38·63	13·96		....
	4	30 H. Camel..	L.C.,nr	"	20 00·20		54·64	08·70	14·06		....
	5	38 Pegasi.....		"	25 42·52		42·97	.....	....	14·10	25 57·07
	6	B.J. 848.......		"	27 22·44		23·22	37·34	....		27 37·32
	7	52 Pegasi.....		"	54 29·92		30·06	.....	....		54 44·16
	8	B.J. 869.......		"	57 34·42		35·07	49·17	14·10		57 49·17
	9	B.J. 871.......		"	23 00 04·82		05·01	19·11	14·10		23 00 19·11
Sept. 26	10	*b* Aquilae.....		N	19 20 28·79	−·043	28·91	.....	....	13·51	19 20 42·42
	11	21 B. Vulp....		"	21 29·99	(·697)	30·28	.....	....		21 43·79
	12	4 Cygni.......		"	22 42·01		42·48	.....	....		22 55·99
	13	α Vulp........		"	24 45·35		45·64	.....	....		24 59·15
	14	B.J. 732.......		"	26 53·14		53·47	06·98	13·51		27 06·98
	15	8 Cygni.......		"	28 13·08		13·51	.....	....		28 27·02
	16	B.D. 70·1073..		"	31 28·92		30·82	.....	....		31 44·33
	17	B.D. 49·3059..		"	33 18·20		18·97	.....	....		33 32·48
	18	B.J. 738.......	r	"	33 48·57		49·34	02·90	....		34 02·85
	19	β Sagittae....		"	36 48·37		48·56	.....	....		37 02·07
	20	10 Vulp.......		"	39 46·19		46·48	.....	....		39 59·99
	21	B.J. 740.......		"	40 49·28		49·76	03·29	13·53		41 03·27
	22	B.J. 742.......		"	41 56·92		57·57	11·10	13·53		42 11·08
	23	B.J. 743.......		"	43 10·46		10·66	24·16	13·50		43 24·17
	24	ζ Sagittae.....		"	44 46·93		47·14	.....	....		45 00·65
	25	B.J. 747.......		"	48 14·54		16·37	.....	....		48 29·88
	26	φ Aquilae.....		"	51 46·74		46·85	.....	....		52 00·36
	27	B.J. 750.......		"	53 05·19		06·03	19·52	....		53 19·54
	28	15 Vulp.......		"	57 11·40		11·72	.....	....		57 25·23
	29	B.D. 69·1084..		"	58 41·04		42·87	.....	....		58 56·38
	30	69 Draconis...		"	20 01 53·46		56·19	.....	....		20 02 09·70
	31	b^2 Cygni......		"	05 52·64		53·11	.....	....		06 06·62
	32	20 Vulp.......		"	08 02·14		02·44	.....	....		08 15·95
	33	30 Cygni......		"	10 15·67		16·35	.....	....		10 29·86
	34	B.J. 759.......		"	11 40·26		43·26	.....	....		11 56·77
	35	176 B. Cygni..		"	16 47·08		47·59	.....	....		17 01·10
	36	B.J. 765.......		"	18 47·45		47·99	01·52	13·53	13·50	19 01·49
	37	40 Cygni......	r	"	24 01·83		02·33	.....	....		24 15·83
	38	41 Cygni......		"	25 30·99		31·35	.....	....		25 44·85
	39	ω^1 Cygni......		"	27 03·57		04·31	.....	....		27 17·81
	40	B.J. 768.......		"	28 43·13		43·23	56·79	13·56		28 56·73
	41	Groom. 3241..		"	30 10·12		12·20	.....	....		30 25·70
	42	B.J. 770.......		"	32 27·74		30·17	.....	....		32 43·67
	43	29 Vulp.......		"	34 18·25		18·49	.....	....		34 31·99
	44	B.J. 774.......		"	35 15·79		15·96	29·45	13·49		35 29·46
	45	B.J. 777.......		"	38 09·39		10·04	23·53	13·49		38 23·54
	46	B.J. 778.......		"	39 03·75		03·90	17·43	13·53		39 17·40
	47	B.J. 780.......		"	42 22·07		22·50	36·02	13·52		42 36·00
	48	B.J. 784.......	r	"	43 42·09		42·56	55·97	13·41		43 56·06
	49	76 Draconis...		"	48 52·82		57·72	11·43	13·71		....

Clamp West. 1—9. Adopted $\Delta T+m=14{\cdot}112-{\cdot}0068$ (T−21ʰ 20ᵐ).
10—49. Adopted $\Delta T+m=13{\cdot}502-{\cdot}0068$ (T−20ʰ 45ᵐ).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 26	1	B.J. 788.......		N	20 53 36·85	−·043	37·40	50·89	13·49	13·50	20 53 50·90
	2	Bradley 2748..		"	55 34·43	(·697)	37·02	.....	....		55 50·52
	3	B.J. 792.......		"	21 01 27·15		27·76	41·29	13·53		21 01 41·26
	4	B.J. 793.......		"	02 39·83		40·33	53·87	13·54		02 53·83
	5	f^2 Cygni.......		"	03 17·68		18·37	.....	....		03 31·87
	6	Groom. 3409..		"	05 37·86		39·80	.....	....		05 53·30
	7	B.J. 795.......		"	07 04·56		07·65	.....	....		07 21·15
	8	B.J. 797.......		"	08 54·42		54·78	08·32	13·54		09 08·28
	9	B.J. 799.......		"	10 59·82		00·32	13·84	13·52		11 13·82
	10	σ Cygni.......		"	13 40·72		41·23	.....	....		13 54·73
	11	B.A.C. 7504...		"	17 17·43		29·02	42·93	13·91		....
	12	1 H. Draconis	L.C.	"	24 10·45		06·07	19·93	13·86		....
	13	B.J. 807.......		"	25 55·53		56·23	09·67	....		26 09·73
	14	72 Cygni......		"	30 53·95		54·45	.....	....		31 07·95
	15	B.J. 811.......		"	33 08·48		09·02	22·51	13·49		33 22·52
	16	B.J. 813.......		"	35 57·65		58·65	12·20	....		36 12·15
	17	B.J. 817.......		"	40 23·50		25·42	.....	....		40 38·92
	18	78 Draconis...	r	"	41 45·54		47·57	.....	....		42 01·07
	19	B.J. 821.......		"	43 15·96		16·70	30·17	....		43 30·20
	20	14 Pegasi.....		"	45 40·10		40·46	.....	....		45 53·96
	21	B.J. 823.......		"	48 46·37		46·66	00·20	13·54	13·49	49 00·15
	22	Bradley 2868..		"	49 52·79		53·75	.....	....		50 07·24
	23	13 Cephei.....	r	"	51 39·33		40·30	.....	....		51 53·79
	24	B.J. 826.......		"	56 30·97		31·10	44·60	13·50		56 44·59
	25	16 Cephei.....		"	57 45·17		47·32	.....	....		58 00·81
	26	B.J. 831.......		"	22 02 37·70		37·99	51·51	13·52		22 02 51·48
	27	B.J. 833.......		"	05 02·64		03·05	16·56	13·51		05 16·54
	28	B.J. 835.......	r	"	05 47·70		48·11	01·60	13·49		06 01·60
	29	B.J. 836.......		"	07 31·64		32·67	46·17	....		07 46·16
	30	1 H. Lacertae		"	09 49·07		49·59	.....	....		10 03·08
	31	Bradley 2942..		"	11 02·45		04·60	.....	....		11 18·09
	32	B.A.C. 3495...	L.C.,nr	"	16 32·24		25·36	39·18	13·82		....
	33	30 H. Camel..	L.C.,nr	"	20 00·93		55·72	09·09	13·37		....
Sept. 27	34	B.J. 817.......	r	S	21 40 23·27	−·043	25·29	.....	....	13·49	21 40 38·78
	35	78 Draconis...		"	41 45·57	(·708)	47·57	.....	....		42 01·06
	36	B.J. 821.......		"	43 15·92		16·64	30·16	....		43 30·13
	37	Bradley 2868..		"	49 52·77		53·70	.....	....		50 07·19
	38	79 Draconis...		"	51 31·05		33·23	.....	....		51 46·72
	39	Bradley 2897..	r	"	56 46·60		49·13	.....	....		57 02·62
	40	16 Cephei.....		"	57 45·10		47·20	.....	....		58 00·69
	41	B.J. 833.......	r	"	22 05 02·66		03·04	16·55	13·51		22 05 16·53
	42	B.J. 835.......		"	05 47·60		48·04	01·59	13·55		06 01·53
	43	B.J. 837.......		"	07 51·87		53·87	.....	....		08 07·36
	44	1 H. Lacertae		"	09 49·06		49·62	.....	....		10 03·11
	45	Bradley 2942..		"	11 02·42		04·53	.....	....		11 18·02
	46	B.A.C. 3495...	L.C.,rn	"	16 33·22		26·22	39·36	13·14		....
	47	30 H. Camel..	L.C.,rn	"	20 01·29		55·99	09·23	13·24		....
	48	B.D. 70·1240..		"	23 28·50		30·32	.....	....		23 43·81
	49	28 Cephei.....	r	"	25 49·16		52·57	.....	....		26 06·06

Clamp West. 1—33. Adopted $\Delta T+m=13{\cdot}502-{\cdot}0068\ (T-20^h\ 45^m)$.
34—49. Adopted clock-rate zero.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 27	1	B.J. 848.......		S	22 27 23·04	—·043	23·79	37·30	....	13·49	22 27 37·28
	2	29 Cephei.....		"	28 52·75	(·708)	55·94	.....	....		29 09·43
	3	226 B. Cephei		"	30 29·04		31·62	.....	....		30 45·11
	4	B.J. 851.......		"	33 20·32		22·48	.....	....		33 35·97
	5	Groom. 3857..		"	35 04·78		07·21	.....	....		35 20·70
	6	B.J. 858.......	r	"	39 52·87		53·41	06·93	13·52		40 06·90
	7	B.J. 869.......		"	57 34·96		35·58	49·16	13·58		57 49·07
	8	5 Andromedae		"	23 03 28·31		29·03	.....	....		23 03 42·52
	9	B.J. 874.......		"	04 49·93		52·36	.....	....		05 05·85
	10	B.J. 875.......		"	08 45·19		46·16	59·64	....		08 59·65
	11	Bradley 3085..		"	11 12·96		15·20	.....	....		11 28·69
	12	Groom. 4033..	r	"	13 56·37		58·95	.....	....		14 12·44
	13	39 H. Cephei..	rn	"	27 35·24		47·56	00·35	12·79		....
	14	Bradley 3217..		"	0 04 09·95		13·40	.....	....		0 04 26·89
	15	B.J. 4.........		"	05 27·00		27·63	41·09	....		05 41·12
	16	B.J. 8.........		"	10 55·35		58·07	.....	....		11 11·56
	17	σ Andromedae		"	13 26·02		26·52	.....	....		13 40·01
	18	ρ Andromedae	r	"	16 11·41		11·89	.....	....		16 25·38
	19	Bradley 34....		"	24 56·36		59·09	.....	....		25 12·58
	20	B.J. 17........		"	31 45·74		46·60	00·11	....		32 00·09
	21	B.J. 20........		"	34 19·55		19·96	33·40	13·44		34 33·45
	22	B.J. 21........		"	35 12·38		13·33	26·74	....		35 26·82
	23	B.J. 24........		"	39 30·44		32·80	.....	....		39 46·29
	24	23 Cass.......		"	41 33·49		35·82	.....	....		41 49·31
	25	η Cass.......		"	43 27·99		28·98	.....	....		43 42·47
	26	ν Andromedae		"	44 39·51		40·10	.....	....		44 53·59
	27	32^2 H. Camel..	L.C.,rn	"	48 12·16		06·09	19·71	13·62		....
	28	B.J. 33........		"	51 34·02		34·55	48·00	13·45		51 48·04
	29	43 H. Cephei..	rn	"	56 08·14		17·40	31·05	13·65		....
	30	Bradley 109...		"	1 01 18·98		22·53	.....	....		1 01 36·02
	31	B.J. 41........		"	04 17·46		20·90	.....	....		04 34·39
	32	Bradley 137...		"	08 20·53		24·06	.....	....		08 37·55
	33	Bradley 155...		"	12 37·59		40·45	.....	....		12 53·94
	34	Bradley 166...		"	16·38·64		41·80	.....	....		16 55·29
	35	B.J. 48........		"	19 43·96		45·06	58·64	....		19 58·55
	36	α Urs. Min....	rn	"	27 02·23		35·75	48·48	12·73		....
	37	B.J. 52........		"	32 16·53		17·23	30·73	....		32 30·72
	38	42 Cass.......		"	35 45·16		46·96	.....	....		36 00·45
	39	B.J. 57........		"	37 49·61		50·36	03·86	....		38 03·85
	40	2 Persei.......	r	"	46 14·35	———	15·19	.....	....	———	46 28·68
Sept. 28	41	69 Draconis...		N	20 01 53·42	—·042	56·37	.....	....	13·47	20 02 09·84
	42	b^2 Cygni......		"	05 52·63	(·752)	53·15	.....	....		06 06·62
	43	20 Vulp.......		"	08 02·17		02·51	.....	....		08 15·98
	44	30 Cygni......		"	10 15·62		16·37	.....	....		10 29·84
	45	B.J. 757.......		"	10 35·13		35·88	49·34	....		10 49·35
	46	B.J. 759.......		"	11 40·29		43·55	.....	....		11 57·02
	47	176 B. Cygni..		"	16 47·08		47·64	.....	....		17 01·11
	48	B.J. 765.......		"	18 47·32		47·90	01·48	13·58		19 01·37
	49	40 Cygni......	r	"	24 01·81		02·35	.....	....		24 15·82

Clamp West. Adopted clock-rate zero.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date.	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T + m$	Adopted $\Delta T + m$	App. R.A. from Observation
					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
1910 Sept. 28	1	41 Cygni......		N	20 25 30·98	—·042	31·38	.....	....	13·47	20 25 44·85
	2	ω^1 Cygni......		"	27 03·61	(·752)	04·41	.....	....		27 17·88
	3	B.J. 768.......		"	28 43·18		43·30	56·76	13·46		28 56·77
	4	Groom. 3241..		"	30 10·01		12·26	.....	....		30 25·73
	5	B.J. 770.......		"	32 27·68		30·31	.....	....		32 43·78
	6	29 Vulp.......		"	34 18·27		18·53	.....	....		34 32·00
	7	B.J. 774.......		"	35 15·79		15·97	29·42	13·45		35 29·44
	8	B.J. 777.......		"	38 09·34		10·04	23·48	13·44		38 23·51
	9	B.J. 778.......		"	39 03·76		03·93	17·40	13·47		39 17·40
	10	B.J. 780.......	r	"	42 21·98		22·44	35·99	13·55		42 35·91
	11	220 H[1]. Drac..		"	51 26·05		30·26	.....	....		51 43·73
	12	B.J. 788.......		"	53 36·73		37·33	50·85	13·52		53 50·80
	13	Bradley 2748..		"	55 34·16		36·98	.....	....		55 50·45
	14	f^1 Cygni.......		"	56 33·49		34·25	.....	....		56 47·72
	15	B.J. 792.......		"	21 01 27·10		27·76	41·25	13·49		21 01 41·23
	16	B.J. 793.......		"	02 39·82		40·36	53·84	13·48		02 53·83
	17	f^2 Cygni.......		"	03 17·59		18·35	.....	....		03 31·82
	18	Groom. 3409..		"	05 37·70		39·80	.....	....		05 53·27
	19	B.J. 795.......		"	07 04·13		07·47	.....	....		07 20·94
	20	B.J. 798.......		"	09 17·91		19·13	32·64	....		09 32·60
	21	B.J. 799.......		"	10 59·84		00·38	13·81	13·43		11 13·85
	22	σ Cygni.......		"	13 40·59		41·15	.....	....		13 54·62
	23	B.A.C. 7504...		"	17 15·69		28·24	42·21	13·97		....
	24	69 Cygni......	r	"	21 54·27		54·78	.....	....		22 08·25
	25	1 H.Draconis..	L.C.,nr	"	24 11·26		06·49	20·14	13·65		....
	26	B.J. 807.......		"	25 55·40		56·16	09·64	....		26 09·63
	27	B.J. 809.......		"	27 16·90		18·89	.....	....		27 32·36
	28	B.J. 811.......		"	33 08·46		09·04	22·48	13·44		33 22·51
	29	B.J. 813.......		"	35 57·56		58·65	12·15	....		36 12·12
	30	B.J. 816.......	r	"	40 22·46		22·78	36·29	13·51		40 36·25
	31	B.J. 821.......		"	43 15·82		16·63	30·14	....		43 30·10
	32	14 Pegasi.....		"	45 40·06		40·45	.....	....		45 53·92
	33	B.J. 823.....		"	48 46·40		46·73	00·18	13·45		49 00·20
	34	Bradley 2868..	r	"	49 52·65		53·70	.....	....		50 07·17
	35	13 Cephei.....		"	51 39·27		40·33	.....	....		51 53·80
	36	Bradley 2897..	r	"	56 46·64		49·25	.....	....		57 02·72
	37	16 Cephei.....		"	57 44·99		47·31	.....	....		58 00·78
	38	B.J. 831.......		"	22 02 37·72		38·04	51·50	13·46		22 02 51·51
	39	B.J. 833.......	r	"	05 02·56		03·00	16·54	13·54		05 16·47
	40	B.J. 835.......		"	05 47·66		48·10	01·58	13·48		06 01·57
	41	B.J. 837.......		"	07 51·95		54·15	.....	....		08 07·62
	42	1 H.Lacertac..		"	09 49·19		49·76	.....	....		10 03·23
	43	B.A.C. 3495...	L.C.,rn	"	16 33·36		25·88	39·54	13·66		....
	44	30 H. Camel..	L.C.,rn	"	20 01·59		55·93	09·37	13·44		....
	45	B.D. 70·1240..		"	23 28·50		30·52	.....	....		23 43·99
	46	B.J. 847.......		"	25 37·42		38·55	52·10	....		25 52·02
	47	B.J. 848.......		"	27 22·97		23·81	37·28	....		27 37·28
	48	29 Cephei.....		"	28 52·39		55·92	.....	....		29 09·39
	49	226 B.Cephei..		"	30 28·99		31·84	.....	....		30 45·31
	50	B.J. 851.......		"	33 20·26		22·65	.....	....		34 36·12

Clamp West. Adopted clock-rate zero.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent ΔT + m	Adopted ΔT + m	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 28	1	B.J. 852.......		N	22 35 01·58	− ·042	02·13	15·63	13·50	13·47	22 35 15·60
	2	B.J. 855.......	r	"	36 47·23	(·752)	47·35	00·85	13·50		37 00·82
	3	B.J. 857.......		"	38 35·39		35·78	49·29	13·51		38 49·25
	4	B.J. 858.......	r	"	39 52·83		53·44	06·92	13·48		40 06·91
	5	B.J. 859.......	r	"	42 00·39		00·68	14·10	13·42		42 14·15
	6	B.J. 862.......		"	45 28·13		28·44	41·91	13·47		45 41·91
	7	52 Pegasi.....		"	54 30·50		30·63	......	....		54 44·10
	8	B.J. 869.......		"	57 35·02		35·65	49·15	13·50		57 49·12
	9	B.J. 870.......		"	59 13·29		13·64	27·03	13·39		59 27·11
Sept. 29	10	ϕ Aquilae.....		S	19 51 46·68	− ·044	46·83	.....	....	13·49	19 52 00·32
	11	B.J. 750.......		"	53 05·08	(·743)	05·94	19·43	....		53 19·43
	12	B.J. 752.......		"	54 33·21		33·46	46·95	13·49		54 46·95
	13	15 Vulp.......		"	57 11·38		11·76	.....	....		57 25·25
	14	B.D. 69·1084..		"	58 40·74		42·63	.....	....		58 56·12
	15	b^2 Cygni......		"	20 05 52·54		53·07	.....	....		20 06 06·56
	16	20 Vulp.......		"	08 02·07		02·42	.....	.....		08 15·91
	17	ρ Aquilae.....		"	09 54·88		55·08	.....	....		10 08·57
	18	B.J. 759.......		"	11 40·18		43·32	.....	....		11 56·81
	19	176 B. Cygni..		"	16 46·98		47·56	.....	....		17 01·05
	20	B.J. 765.......	r	"	18 47·40		47·94	01·46	13·52		19 01·43
	21	40 Cygni......		"	24 01·73		02·30	.....	....		24 15·79
	22	41 Cygni......		"	25 30·89		31·31	.....	....		25 44·80
	23	ω^1 Cygni......		"	27 03·54		04·30	.....	....		27 17·79
	24	B.J. 768.......		"	28 43·16		43·30	56·75	13·45		28 56·79
	25	Groom. 3241..		"	30 09·79		11·93	.....	....		30 25·42
	26	B.J. 770.......		"	32 27·43		29.93	.....	....		32 43·42
	27	74 Draconis...	nr	"	34 24·92		29·33	.....	....		34 42·82
	28	B.J. 777.......		"	38 09·27		09·99	23·46	13·47		38 23·48
	29	B.J. 778.......		"	39 03·72		03·91	17·38	13·47		39 17·40
	30	B.J. 780.......	r	"	42 22·03		22·46	35·97	13·51		42 35·95
	31	B.J. 784.......		"	43 41·89		42·41	55.91	13·50		43 55·90
	32	76 Draconis...	nr	"	48 52·05		57·27	10·95	13·68		....
	33	220 H^1.Drac..	nr	"	51 25·63		29·78	43·55	13·77		....
	34	B.J. 788.......		"	53 36·71		37·33	50·83	13·50		53 50·82
	35	Bradley 2748..		"	55 33·98		36·66	.....	....		55 50·15
	36	B.J. 792.......		"	21 01 27·01		27·70	41·23	13·53		21 01 41·19
	37	f^2 Cygni......		"	03 17·65		18·36	.....	....		03 31·85
	38	Groom. 3409..		"	05 37·67		39·67	.....	....		05 53·16
	39	B.J. 795.......		"	07 03·98		07·15	.....	....		07 20·64
	40	B.J. 798.......		"	09 17·97		19·12	32·61	......		09 32·61
	41	B.J. 799.......	r	"	10 59·83		00·32	13·79	13·47		11 13·81
	42	Bradley 2796..		"	16 27·59		30·49	.....	....		16 43·98
	43	69 Cygni......		"	21 54·25		54·77	.....	....		22 08·26
	44	1 H.Draconis..	L.C.,nr	"	24 11·53		06·01	20·38	14·37		....
	45	B.J. 807.......		"	25 55·40		56·08	09·62	......		26 09·57
	46	Groom. 3511..		"	27 15·27		19·24	.....	....		27 32·73
	47	ρ Cygni.......		"	30 23·45		24·18	.....	....		30 37·67
	48	B.J. 811.......		"	33 08·35		08·95	22·46	13·51		33 22·44
	49	B.J. 813.......		"	35 57·50		58·53	12·12	....		36 12·02

Clamp West. Adopted clock-rate zero.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T + m$	Adopted $\Delta T + m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 29	1	B.J. 817.......		S	21 40 23·13	—·044	25·11	.....	....	13·49	21 40 38·60
	2	78 Draconis...	r	"	41 45·06	(·743)	47·30	.....	....		42 00·79
	3	B.J. 821.......		"	43 15·80		16·56	30·12	....		43 30·05
	4	14 Pegasi.....		"	45 39·95		40·36	.....	....		45 53·85
	5	B.J. 823.......		"	48 46·32		46·67	00·17	13·50		49 00·16
	6	Bradley 2868..	r	"	49 52·59		53·65	.....	....		50 07·14
	7	13 Cephei.....		"	51 39·18		40·18	.....	....		51 53·67
	8	Bradley 2897..		"	56 46·47		48·96	.....	....		57 02·45
	9	16 Cephei	r	"	57 44·66		47·02	.....	....		58 00·51
	10	B.J. 831.......		"	22 02 37·68		38·01	51·49	13·48		22 02 51·50
	11	B.J. 833.......		"	05 02·57		03·03	16·53	13·50		05 16·52
	12	28 Pegasi.....		"	06 03·42		03·68	.....	....		06 17·17
	13	B.J. 837.......		"	07 51·87		53·96	.....	....		08 07·45
	14	1 H.Lacertae..		"	09 49·00		49·59	.....	....		10 03·08
	15	Bradley 2942..		"	11 02·18		04·40	.....	....		11 17·89
	16	B.A.C. 3495...	L.C.,nr	"	16 33·82		26·46	39·70	13·24		....
	17	30 H.Camel...	L.C.,nr	"	20 01.92		56·35	09·50	13·15		....
	18	B.D. 70·1240..		"	23 28·53		30·44	.....	....		23 43.93
	19	28 Cephei.....		"	25 49·04		52·37	.....	....		26 05·86
	20	B.J. 848.......		"	27 22·92		23·70	37·27	....		27 37·19
	21	29 Cephei.....	r	"	28 52·19		55·77	.....	....		29 09·26
	22	B.J. 851.......		"	33 20·17		22·44	.....	....		33 35·93
	23	Groom. 3857..		"	35 04·63		07·19	.....	....		35 20·68
	24	52 Pegasi.....		"	54 30·50		30·65	.....	....		54 44·14
	25	B.J. 869.......	r	"	57 35·01		35·60	49·14	13·54		57 49·09
	26	B.J. 870.......		"	59 13·15		13·53	27·03	13·50		59 27·02
	27	B.J. 871.......		"	23 00 05·40		05·59	19·10	13·51		23 00 19·08
	28	5 Andromedae		"	03 28·25		29·01	.....	....		03 42·50
	29	B.J. 874.......	r	"	04 49·48		52·21	.....	....		05 05·70
	30	B.J. 875.......		"	08 45·05		46·07	59·62	....		08 59·56
	31	Bradley 3085..		"	11 12·86		15·22	.....	......		11 28·71
	32	B.J. 880.......		"	15 59·51		59.82	13·36	13·54		16 13·31
	33	B.J. 881.......	r	"	20 41·94		42·19	55·68	13·49		20 55·68
	34	B.J. 885.......		"	24 25·04		25·20	38·69	13·49		24 38·69
	35	39 H. Cephei..	nr	"	27 34·21		47·13	00·06	12·93		....
	36	B.J. 890.......		"	32 57·82		58·49	12·01	......		33 11·98
	37	Groom. 4119..		"	35 06·33		08·85	.....	....		35 22·34
	38	ψ Andromedae		"	41 22·73		23·40	.....	....		41 36·89
Sept. 30	39	λ Urs. Min....		N	19 09 33·29	—·034	15·40	30·06	14·66	13·45	....
	40	b Aquilae.....		"	20 28·75	(·740)	28·89	.....	....		19 20 42·34
	41	21 B.Vulp.....	r	"	21 29·94		30·26	.....	....		21 43·71
	42	4 Cygni.......		"	22 41·95		42·46	.....	....		22 55·91
	43	α Vulp........		"	24 45·26		45·58	.....	....		24 59·03
	44	B.J. 733.......		"	27 12·85		13·73	27·25	....		27 27·18
	45	8 Cygni.......		"	28 13·01		13·48	.....	....		28 26·93
	46	B.D. 49·3059..	r	"	33 18·11		18·94	.....	....		33 32·39
	47	B.J. 738.......		"	33 48·54		49·37	02·78	....		34 02·82
	48	14 Cygni......		"	36 17·84		18·48	.....	....		36 31·93
	49	10 Vulp.......		"	39 46·14		46·47	.....	....		39 59.92

Clamp West. Adopted clock-rate zero.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date.	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 30	1	B.J. 740......		N	19 40 49·24	—·034	49·77	03·20	13·43	13·45	19 41 03·22
	2	B.J. 742.......		"	41 56·80	(·740)	57·50	10·99	13·49		42 10·95
	3	B.J. 743.......		"	43 10·42		10·64	24·09	13·45		43 24·09
	4	ζ Sagittae ...	r	"	44 46·90		47·13	.....	....		45 00·58
	5	φ Aquilae		"	51 46·68		46·81	.....	....		52 00·26
	6	B.J. 750......		"	53 05·03		05·94	19·40	....		53 19·39
	7	B.J. 752.......		"	54 33·23		33·47	46·93	13·46		54 46·92
	8	15 Vulp.......		"	57 11·41		11·77	.....	....		57 25·22
	9	Groom. 1119..	L.C.	"	20 09 16·61		40·76	55·27	14·51		....
	10	176 B.Cygni...		"	16 47·01		47·57	.....	....		20 17 01·02
	11	B.J. 765.......		"	18 47·40		47·98	01·44	13·46		19 01·43
	12	40 Cygni......	r	"	24 01·76		02·30	.....	....		24 15·75
	13	41 Cygni......		"	25 30·90		31·30	.....	....		25 44·75
	14	ω¹ Cygni......		"	27 03·57		04·37	.....	....		27 17·82
	15	B.J. 768.......		"	28 43·17		43·29	56·73	13·44		28 56·74
	16	ζ Delphini....		"	30 54·36		54·53	.....	....		31 07·98
	17	B.J. 771.......	r	"	33 08·01		08·18	21·64	13·46		33 21·63
	18	29 Vulp.......		"	34 18·26		18·52	.....	....		34 31·97
	19	B.J. 774.......		"	35 15·79		15·98	29·39	13·41		35 29·43
	20	B.J. 777.......		"	38 09·18		09·88	23·44	13·56		38 23·33
	21	B.J. 778.......		"	39 03·78		03·95	17·37	13·42		39 17·40
	22	B.J. 780.......		"	42 21·97		22·44	35·95	13·51		42 35·89
	23	B.J. 784.......	r	"	43 41.92		42·43	55·89	13·46		43 55·88
	24	76 Draconis...		"	48 51·98		57·25	10·79	13·54		....
	25	220 H¹. Drac..		"	51 25·59		29·77	.....	....		51 43·22
	26	B.J. 788.......		"	53 36·74		37·34	50·81	13·47		53 50·79
	27	f¹ Cygni......		"	56 33·42		34·18	.....	....		56 47·63
	28	B.J. 792.......		"	21 01 26·98		27·64	41·21	13·57		21 01 41·09
	29	B.J. 793.......		"	02 39·85		40·39	53·80	13·41		02 53·84
	30	f² Cygni.....		"	03 17·57		18·33	.....	....		03 31·78
	31	B.J. 798.......		"	09 17·89		19·11	32·57	....		09 32·56
	32	B.J. 799.......		"	10 59·79		00·33	13·77	13·44		11 13·78
	33	υ Cygni.......		"	14 01·01		01·49	.....	....		14 14·94
	34	B.J. 804.......		"	17 43·83		44·07	57·52	13·45		17 57·52
	35	69 Cygni......		"	21 54·32		54·83	.....	....		22 08·28
	36	B.J. 807.......		"	25 55·46		56·22	09·60	....		26 09·67
	37	ρ Cygni.......		"	30 23·47		24·18	.....	....		30 37·63
	38	B.J. 811.......		"	33 08·43		09·01	22·45	13·44		33 22·46
	39	B.J. 813.......		"	35 57·53		58·62	12·10	....		36 12·07
	40	B.J. 816.......	r	"	40 22·49		22·82	36·27	13·45		40 36·27
	41	B.J. 821.......		"	43 15·84		16·65	30·10	....		43 30·10
	42	14 Pegasi.....		"	45 40·05		40·44	.....	....		45 53·89
	43	B.J. 823......		"	48 46·39		46·72	00·15	13·43		49 00·17
	44	Bradley 2868..		"	49 52·56		53·60	.....	....		50 07·05
	45	13 Cephei.....	r	"	51 39·19		40·24	.....	....		51 53·69
	46	B.J. 826.......		"	56 31·00		31·15	44·56	13·41		56 44·60
	47	B.J. 831.......		"	22 02 37·67		37·99	51·48	13·49		22 02 51·44
	48	B.J. 833.......		"	05 02·61		03·05	16·51	13·46		05 16·50
	49	B.J. 835.......	r	"	05 47·66		48·10	01·55	13·45		06 01·55
	50	B.J. 836.......		"	07 31·56		32·68	46·09	....		07 46·13

Clamp West. Adopted clock-rate zero.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Sept. 30	1	1 H.Lacertae..		N	22 09 49·01	−·034	49·58	......	......	13·45	22 10 03·03
	2	B.A.C. 3495...	L.C.	"	16 33·71	(·740)	26·26	39·88	13·62		....
	3	B.J. 844.......		"	19 49·13		50·02	03·44	......		20 03·47
	4	B.J. 847.......		"	25 37·46		38·59	52·06	......		25 52·04
	5	B.J. 848.......		"	27 22·96		23·78	37·25	......		27 37·23
	6	B.J. 852.......		"	35 01·59		02·14	15·61	13·47		35 15·59
	7	B.J. 855.......		"	36 47·31		47·42	00·84	13·42		37 00·87
	8	B.J. 857.......		"	38 35·37		35·76	49·28	13·52		38 49·21
	9	B.J. 858.......		"	39 52·86		53·47	06·90	13·43		40 06 92
	10	B.J. 859.......		"	42 00·36		00·66	14·09	13·43		42 14·11
	11	B.J. 862.......	r	"	45 28·09		28·40	41·90	13·50		45 41·85
Oct. 3	12	B.J. 780.......		N	20 42 21·67	−·045	22·14	35·89	13·75	13·75	20 42 35·89
	13	B.J. 804.......		"	21 17 43·47	(·764)	43·71	57·49	13·78		21 17 57·46
	14	1 H.Draconis..	L.C.	"	24 11·74		06·91	20·90	13·99	13·76	....
	15	B.J. 831.......		"	22 02 37·39		37·70	51·45	13·75		22 02 51·46
	16	B.J. 833.......	r	"	05 02·18		02·63	16·48	13·85		05 16·39
	17	B.J. 835.......		"	05 47·27		47·72	01·52	13·80		06 01·48
	18	B.J. 836.......		"	07 31·18		32·32	46·03	......		07 46·08
	19	1 H.Lacertae..		"	09 48·63		49·21	......	......		10 02·97
	20	B.A.C. 3495...	L.C.	"	16 34·33		26·75	40·34	13·59		....
	21	30 H.Camel...	L.C.	"	20 02·32		56·58	09·97	13·39		....
	22	B.J. 847.......		"	25 37·09		38·24	52·01	......		25 52·00
	23	B.J. 848.......		"	27 22·58		23·42	37·21	......		27 37·18
	24	B.J. 852.......		"	35 01·23		01·79	15·58	13·79		35 15·55
	25	B.J. 857.......		"	38 35·04		35·44	49·26	13·82		38 49·20
	26	B.J. 858.......		"	39 52·61		53·23	06·87	13·64		40 06·99
	27	B.J. 859.......		"	42 00·08		00·38	14·07	13·69		42 14·14
	28	B.J. 862.......		"	45 27·77		28·07	41·88	13·81		45 41·83
	29	B.J. 869.......		"	57 34·75		35·39	49·12	13·73		57 49·15
	30	B.J. 870.......		"	59 12·91		13·27	27·02	13·75		59 27·03
	31	B.J. 875.......		"	23 08 44·73		45·82	59·58	......		23 08 59·58
	32	B.J. 880.......		"	15 59·27		59·57	13·35	13·78		16 13·33
	33	B.J. 881.......		"	20 41·61		41·90	55·67	13·77		20 55·66
	34	39 H.Cephei...		"	27 33·04		46·33	59·58	13·25	13·77	....
	35	B.J. 890.......		"	32 57·44		58·17	12·00	......		33 11·94
Oct. 7	36	Groom. 1119..	L.C.,nr	N	20 09 23·65	−·046	49·80	03·35	13·55	14·48	....
	37	176 B.Cygni...		"	16 45·84	(·713)	46·37	......	......		20 17 00·85
	38	B.J. 765.......	r	"	18 46·21		46·76	01·27	14·51		19 01·24
	39	40 Cygni......		"	24 00·62		01·13	......	......	14·49	24 15·62
	40	41 Cygni......		"	25 29·81		30·18	......	......		25 44·67
	41	ω^1 Cygni		"	27 02·35		03·10	......	......		27 17·59
	42	B.J. 768.......		"	28 42·06		42·17	56·63	14·46		28 56·66
	43	ζ Delphini....	r	"	30 53·22		53.38	......	......		31 07·87
	44	B.J. 771.......		"	33 06·94		07·09	21·54	14·45		33 21·58
	45	29 Vulp.......		"	34 17·10		17·34	......	......		34 31·83
	46	B.J. 774.......		"	35 14·57		14·74	29·29	14·55		35 29·23
	47	B.J. 777.......		"	38 08·09		08·74	23·27	14·53		38 23·23
	48	B.J. 778.......		"	39 02·67		02·83	17·26	14·43		39 17·32

Clamp West. 1−11. Adopted clock-rate zero.
12−35. Adopted $\Delta T+m=13·758+·0050\ (T-22^h\ 00^m)$.
36—48. Adopted $\Delta T+m=14·505+·0136\ (T-21^h\ 50^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 7	1	B.J. 780......	r	N	20 42 20·86	– ·046	21·30	35.82	14·52	14·49	20 42 35·79
	2	B.J. 784.....		"	43 40·76	(·713)	41·23	55·75	14·52		43 55·72
	3	76 Draconis...		"	48 50·23		55·23	09·80	14·57		....
	4	220 H[1] Drac...	nr	"	51 24·05		28·02	....	....		51 42·51
	5	B.J. 788.....		"	53 35·63		36·19	50·66	14·47		53 50·68
	6	f^1 Cygni......		"	56 32·22		32·93	.....	....		56 47·42
	7	B.J. 792.......		"	21 01 25·84		26·46	41·06	14·60		21 01 40·95
	8	B.J. 793......		"	02 38·64		39·15	53·67	14·52		02. 53·64
	9	f^2 Cygni....		"	03 16·43		17·14	.....	....		03 31·63
	10	B.J. 798......		"	09 16·68		17·82	32·34	....	14·50	09 32·32
	11	B.J. 799.......		"	10 58·61		59·11	13·65	14·54		11 13·61
	12	σ Cygni.......		"	13 39·49		40·02	.....	......		13 54·52
	13	B.A.C. 7504...	nr	"	17 12·53		24·36	39·42	15·06		....
	14	69 Cygni...	r	"	21 53·20		53·67	.....	....		22 08·17
	15	1 H.Draconis..	L.C.,rn	"	24 11·48		07·00	21·40	14·40		....
	16	B.J. 807.......		"	25 54·25		54·93	09·46	......		26 09·43
	17	ρ Cygni.......		"	30 22·26		22·92	.....	......		30 37·42
	18	B.J. 811.......		"	33 07·26		07·81	22·34	14·53		33 22·31
	19	B.J. 813.....		"	35 56·34		57·37	11·91	....		36 11·87
	20	B.J. 816......		"	40 21·34		21·64	36·19	14·55		40 36·14
	21	B.J. 821......		"	43 14·68		15·44	29·96	......		43 29·94
	22	14 Pegasi.....		"	45 38·91		39·28	.....	....		45 53·78
	23	B.J. 823.......	r	"	48 45·24		45·54	00·08	14·54		49 00·04
	24	Bradley 2868..	r	"	49 51·52		52·50	.....	.....		50 07·00
	25	13 Cephei...		"	51 38·11		39·10	...	....	14·51	51 53·61
	26	B.J. 826.....		"	56 29·84		29·97	44·50	14·53		56 44·48
	27	B.J. 831.....		"	22 02 36·55		36·84	51·41	14·57		22 02 51·35
	28	B.J. 833.....	r	"	05 01·57		01·99	16·44	14·45		05 16·50
	29	B.J. 835.......		"	05 46·59		47·01	01·48	14·47		06 01·52
	30	B.J. 836.......		"	07 30·38		31·44	45·94	.... .		07 45·95
	31	1 H.Lacertae..		"	09 47·86		48·39	.....	.... ..		10 02·90
	32	B.A.C. 3495...	L.C.,rn	"	16 33·31		26·29	41·00	14·71		....
	33	30 H.Camel...	L.C.,rn	"	20 01·11		55·79	10·41	14·62		....
	34	B.J. 847.......		"	25 36·27		37·34	51·93	....		25 51·85
	35	B.J. 848.......		"	27 21·71		22·49	37·16	......		27 37·00
	36	B.J. 852.......		"	35 00·48		01·00	15·55	14·55	14·52	35 15·52
	37	B.J. 855.......		"	36 46·22		46·32	00·80	14·48		37 00·84
	38	B.J. 857.......		"	38 34·33		34·70	49·23	14·53		38 49·22
	39	B.J. 858.......		"	39 51·61		52·19	06·84	14·65		40 06·71
	40	B.J. 859.......		"	41 59·25		59·53	14·05	14·52		42 14·05
	41	B.J. 862.......	r	"	45 27·04		27·32	41·86	14·54		45 41·84
	42	52 Pegasi.....	r	"	54 29·52		29·63	..	.....		54 44·15
	43	B.J. 869.......	r	"	57 33·98		34·57	49·09	14·52		57 49·09
	44	B.J. 870.......		"	59 12·22		12·55	27·00	14·45		59 27·07
	45	B.J. 871.......		"	23 00 04·42		04·58	19·08	14·50		23 00 19·10
	46	5 Andromedae		"	03 27·11		27·86	.....	......		03 42·38
	47	B.J. 875.......		"	08 44·02		45·03	59·55	....		08 59·55
	48	B.J. 881.......		"	20 40·94		41·21	55·67	14·46	14·53	20 55·74
	49	B.J. 885.......		"	24 24·08		24·21	38·68	14·47		24 38·74
	50	39 H. Cephei..	rn	"	27 33·15		45·51	59·20	13·69		....

Clamp West. 1—50. Adopted $\Delta T+m=14{\cdot}505+{\cdot}0136$ $(T-21^h\ 50^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 10	1	Groom. 1119..	L.C.,nr	N	20 09 26·15	−·048	53·33	07·36	14·03	15·29	....
	2	176 B.Cygni...		"	16 44·96	(·705)	45·48	.....	....	15·30	20 17 00·78
	3	B.J. 765.......		"	18 45·37		45·91	01·20	15·29		19 01 21
	4	40 Cygni......	r	"	23 59·73		00·24	.....	....		24 15·54
	5	41 Cygni......		"	25 28·92		29·28	.....	....		25 44·58
	6	ω¹ Cygni......		"	27 01·45		02·19	.....	....		27 17·49
	7	Groom. 3241..		"	30 07·31		09·39	.....	....		30 24·69
	8	B.J. 770.......		"	32 24·71		27·15	.....	....		32 42·45
	9	29 Vulp.......		"	34 16·30		16·53	.....	....		34 31·83
	10	B.J. 774.....		"	35 13·72		13·89	29·24	15·35		35 29·19
	11	B.J. 777.....		"	38 07·15		07·80	23·20	15·40		38 23·10
	12	B.J. 778......		"	39 01·73		01·88	17·22	15·34		39 17·18
	13	B.J. 780.......		"	42 19·96		20·38	35·76	15·38		42 35·68
	14	B.J. 784.......	r	"	43 39·92		40·38	55·69	15·31		43 55·68
	15	76 Draconis...		"	48 48·81		53·73	09·29	15·56		....
	16	220 H¹. Drac..	r	"	51 22·69		26·59	.....	....		51 41·89
	17	B.J. 788.......		"	53 34·72		35·27	50·60	15·33		53 50·57
	18	Bradley 2748..		"	55 31·32		33·92	.....	....	15·31	55 49·23
	19	f¹ Cygni......		"	56 31·33		32·03	.....	....		56 47·34
	20	B.J. 792.......		"	21 01 25·01		25·62	40·99	15·37		21 01 40·93
	21	B.J. 793.......		"	02 37·77		38·28	53·61	15·33		02 53·59
	22	f² Cygni......		"	03 15·51		16·21	.....	....		03 31·52
	23	Groom. 3409..		"	05 35·20		37·15	.....	....		05 52·46
	24	B.J. 795.......		"	07 01·39		04·48	.....	....		07 19·79
	25	B.J. 798.......		"	09 15·67		16·80	32·23	....		09 32·11
	26	B.J. 799.......	r	"	10 57·77		58·26	13·60	15·34		11 13·57
	27	υ Cygni........		"	13 58·98		59·42	.....	....		14 14·73
	28	Bradley 2796..		"	16 24·85		27·67	.....	....		16 42·98
	29	69 Cygni.......		"	21 52·38		52·84	.....	....		22 08·15
	30	1 H.Draconis..	L.C.,nr	"	24 10·80		06·39	21·86	15·47		....
	31	B.J. 807.......		"	25 53·36		54·03	09·39	....		26 09·34
	32	B.J. 809.......		"	27 14·58		16·42	.....	....		27 31·73
	33	72 Cygni......		"	30 51·90		52·41	.....	....		31 07·72
	34	B.J. 811.......		"	33 06·40		06·93	22·28	15·35		33 22·24
	35	B.J. 813.......		"	35 55·53		56·54	11·82	....		36 11·85
	36	B.J. 817.......	r	"	40 20·92		22·85	.....	....	15·32	40 38·17
	37	78 Draconis...		"	41 43·02		45·06	.....	....		42 00·38
	38	B.J. 821.......		"	43 13·80		14·54	29·90	....		43 29·86
	39	14 Pegasi.....		"	45 38·07		38·43	.....	....		45 53·75
	40	B.J. 823.......		"	48 44·45		44·75	00·03	15·28		49 00·07
	41	Bradley 2868..		"	49 50·65		51·62	.....	....		50 06·94
	42	13 Cephei.....	r	"	51 37·12		38·09	.....	....		51 53·41
	43	Bradley 2897..		"	56 44·10		46·52	.....	....		57 01·84
	44	16 Cephei.....	r	"	57 42·58		44·73	.....	....		58 00·05
	45	B.J. 831.......		"	22 02 35·82		36·10	51·37	15·27		22 02 51·42
	46	B.J. 833.......		"	05 00·69		01·09	16·39	15·30		05 16·41
	47	B.J. 835.......	r	"	05 45·69		46·09	01·42	15·33		06 01·41
	48	B.J. 836.......		"	07 29·48		30·51	45·87	....		07 45·83
	49	1 H.Lacertae..		"	09 47·07		47·60	.....	....		10 02·92
	50	Bradley 2942..		"	10 59·86		02·03	.....	....		11 17·35

Clamp West. 1—50. Adopted $\Delta T+m=15{\cdot}318+{\cdot}0140$ (T−21ʰ 50ᵐ).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 10	1	B.A.C. 3495...	L.C.,rn	N	22 16 33·11	— ·048	26·20	41·46	15·26	15·32	....
	2	30 H.Camel...	L.C.,rn	"	20 00·48	(·705)	55·25	10·81	15·56	5·33	....
	3	B. D. 70·1240..		"	23 26·32		28·18	.....	....		22 23 43·51
	4	B.J. 847.......		"	25 35·45		36·50	51·87	....		25 51·83
	5	B.J. 848.......		"	27 20·92		21·68	37·10	....		27 37·01
	6	29 Cephei.....		"	28 49·92		53·19	.....	....		29 08·52
	7	226 B.Cephei.		"	30 26·42		29·06	.....	....		30 44·39
	8	B.J. 851.......		"	33 17·87		20·08	.....	....		33 35·41
	9	B.J. 852.......		"	34 59·65		00·16	15·51	15·35		35 15·49
	10	B.J. 855.......	r	"	36 45·39		45·49	00·78	15·29		37 00·82
	11	B.J. 857.......		"	38 33·53		33·89	49·20	15·31		38 49·22
	12	B.J. 858.......	r	"	39 50·86		51·42	06·80	15·38		40 06·75
	13	B.J. 859.......	r	"	41 58·43		58·69	14·02	15·33		42 14·02
	14	B.J. 862.......		"	45 26·21		26·49	41·84	15·35		45 41·82
	15	52 Pegasi......		"	54 28·67		28·78	.....	....		54 44·11
	16	B.J. 869.......		"	57 33·14		33·71	49·05	15·34		57 49·04
	17	B.J. 870.......		"	59 11·36		11·69	26·98	15·29		23 00 27·02
	18	B.J. 874.......	r	"	23 04 47·42		49·91	.....	....	15·34	05 05·25
	19	B.J. 875.......		"	08 43·10		44·09	59·50	....		08 59·43
	20	Groom. 4033..		"	13 54·16		56·61	.....	....		14 11·95
	21	B.J. 880......	r	"	15 57·78		58·04	13·32	15·28		16 13·38
	22	B.J. 881.......		"	20 40·08		40·34	55·65	15·31		20 55·68
	23	39 H. Cephei..	rn	"	27 31·74		43·92	58·76	14·84		....
Oct. 11	24	20 Vulp.......		S	20 07 59·76	— ·049	00·09	.....	....	15·58	20 08 15·67
	25	ρ Aquilae.....		"	09 52·59	(·723)	52·78	.....	....		10 08·36
	26	B.J. 759.......		"	11 37·09		40·07	.....	....		11 55·65
	27	176 B. Cygni..		"	16 44·65		45·21	.....	....		17 00·79
	28	40 Cygni......	r	"	23 59·47		59·96	.....	....	15·59	24 15·55
	29	41 Cygni......		"	25 28·56		28·96	.....	....		25 44·55
	30	ω^1 Cygni......		"	27 01·20		01·92	.....	....		27 17·51
	31	B.J. 768.......		"	28 40·86		40·99	56·57	15·58		28 56·58
	32	ζ Delphini.....	r	"	30 52·05		52·18	.....	....		31 07·77
	33	B.J. 770.......		"	32 24·50		26·91	.....	....		32 42·50
	34	74 Draconis...	rn	"	34 21·49		25·74	.....	....		34 41·33
	35	B.J. 777.......		"	38 06·90		07·59	23·17	15·58		38 23·18
	36	B.J. 778.......		"	39 01·42		01·60	17·20	15·60		39 17·19
	37	B.J. 780.......		"	42 19·66		20·12	35·74	15·62		42 35·71
	38	B.J. 784.......	r	"	43 39·62		40·07	55·67	15·60		43 55·66
	39	76 Draconis...	rn	"	48 48·32		53·35	09·12	15·77		....
	40	220 H[1]. Drac..	rn	"	51 22·49		26·49	42·09	15·60		....
	41	B.J. 788.......		"	53 34·40		34·99	50·58	15·59		53 50·58
	42	Bradley 2748..		"	55 31·10		33·68	.....	....		55 49·27
	43	B.J. 792.......		"	21 01 24·72		25·38	40·97	15·59		21 01 40·97
	44	f^2 Cygni.......		"	03 15·27		15·95	.....	....	15·60	03 31·55
	45	Groom. 3409..		"	05 34·93		36·85	.....	....		05 52·45
	46	B.J. 795.......		"	07 01·09		04·15	.....	....		07 19·75
	47	B.J. 798.......		"	09 15·43		16·54	32·20	....		09 32·14
	48	B.J. 799.......		"	10 57·45		57·99	13·58	15·59		11 13·59

Clamp West. 1—23. Adopted $\Delta T+m=15{\cdot}318+{\cdot}0140$ (T—21^h 50^m).
24—48. Adopted $\Delta T+m=15{\cdot}598+{\cdot}0141$ (T—21^h 15^m).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 11	1	Bradley 2796..		S	21 16 24·54	—·049	27·33	....	....	15·60	21 16 42·93
	2	69 Cygni......	r	"	21 52·05	(·723)	52·50	....	....		22 08·10
	3	1 H.Draconis..	L.C.,rn	"	24 10·78		06·27	22·03	15·76		....
	4	B.J. 807.......		"	25 53·13		53·78	09·37	....		26 09·38
	5	B.J. 811.......		"	33 06·06		06·64	22·26	15·62		33 22·24
	6	B.J. 817.......		"	40 20·57		22·47	....	....		40 38·07
	7	78 Draconis...	r	"	41 42·55		44·71	....	....		42 00·31
	8	B.J. 821.......		"	43 13·50		14·23	29·87	....		43 29·83
	9	14 Pegasi.....		"	45 37·71		38·10	....	....	15·61	45 53·71
	10	B.J. 823.......		"	48 44·04		44·37	00·02	15·65		48 59·98
	11	79 Draconis...		"	51 28·22		30·42	....	....		51 46·03
	12	B.J. 826.......		"	56 28·71		28·87	44·46	15·59		56 44·48
	13	16 Cephei.....		"	57 42·31		44·44	....	....		58 00·05
	14	B.J. 831.......		"	22 02 35·40		35·71	51·36	15·65		22 02 51·32
	15	B.J. 833.......		"	05 00·26		00·70	16·38	15·68		05 16·31
	16	28 Pegasi.....		"	06 01·20		01·46	....	....		06 17·07
	17	B.J. 837.......		"	07 49·37		51·39	....	....		08 07·00
	18	Bradley 2942..		"	10 59·47		01·61	....	....		11 17·22
Oct. 12	19	40 Cygni......		N	20 23 58·72	·068	59·44	....	....	16·03	20 24 15·47
	20	41 Cygni......		"	25 28·00	(·792)	28·54	....	....		25 44·57
	21	ω^1 Cygni......		"	27 00·54		01·55	....	....		27 17·58
	22	Groom. 3241..		"	30 06·10		08·78	....	....		30 24·81
	23	B.J. 770.......		"	32 23·44		26·55	....	....		32 42·58
	24	B.J. 774.......		"	35 12·86		13·15	29·21	16·06		35 29·18
	25	B.J. 777.......		"	38 06·16		07·05	23·14	16·09		38 23·08
	26	B.J. 778.......		"	39 00·85		01·13	17·19	16·06		39 17·16
	27	B.J. 780.......		"	42 19·09		19·71	35·72	16·01		42 35·74
	28	B.J. 784.......	r	"	43 39·04		39·71	55·65	15·94		43 55·74
	29	76 Draconis...	nr	"	48 46·38		52·59	08·94	16·35		....
	30	220 H^1. Drac..	nr	"	51 20·89		25·83	....	....		51 41·86
	31	Bradley 2748..		"	55 29·65		32·98	....	....	16·04	55 49·02
	32	B.J. 792.......		"	21 01 24·01		24·86	40·95	16·09		21 01 40·90
	33	B.J. 793.......		"	02 36·86		37·58	53·57	15·99		02 53·62
	34	B.J. 795.......		"	06 59·72		03·65	....	....		07 19·69
	35	B.J. 798.......		"	09 14·60		16·09	32·16	....		09 32·13
	36	B.J. 799.......		"	10 56·80		57·50	13·56	16·06		11 13·54
	37	v Cygni... ...		"	13 58·01		58·65	....	....		14 14·69
	38	B.A.C. 7504...	nr	"	17 06·70		21·29	37·53	16·24		....
	39	69 Cygni......	r	"	21 51·35		52·02	....	....		22 08·06
	40	1 H.Draconis..	L.C.,nr	"	24 11·41		05·86	22·20	16·34		....
	41	72 Cygni......		"	30 50·97		51·69	....	....		31 07·73
	42	B.J. 811.......		"	33 05·39		06·15	22·24	16·09		33 22·19
	43	B.J. 813.......		"	35 54·31		55·66	11·76	....	16·05	36 11·71
	44	B.J. 817.......		"	40 19·39		21·88	....	....		40 37·93
	45	78 Draconis...	r	"	41 41·52		44·14	....	....		42 00·19
	46	B.J. 821.......		"	43 12·78		13·80	29·85	....		43 29·85
	47	14 Pegasi.....		"	45 37·05		37·58	....	....		45 53·63
	48	B.J. 823.......		"	48 43·41		43·87	00·01	16·14		48 59·92
	49	Bradley 2868..		"	49 49·46		50·75	....	....		50 06·80

From Oct. 11 Clamp West; from Oct. 12 Clamp East.
1—18. Adopted $\Delta T+m=15\cdot598+\cdot0141$ $(T-21^h\ 15^m)$.
19—49. Adopted $\Delta T+m=16\cdot046+\cdot0142$ $(T-21^h\ 40^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 12	1	13 Cephei	r	N	21 51 35·99	·068	37·30	....	....	16·05	21 51 53·35
	2	Bradley 2897		"	56 42·49	(·792)	45 59	....	....		57 01·64
	3	16 Cephei		"	57 41·15		43·91	....	....		57 59·96
	4	B.J. 831		"	22 02 34·82		35·26	51·35	16·09		22 02 51·31
	5	B.J. 833		"	04 59·70		00·30	16·37	16·07		05 16·35
	6	B.J. 835	r	"	05 44·85		45·45	01·41	15·96		06 01·50
	7	B.J. 837		"	07 48·21		50·83	....	....		08 06·88
	8	1 H.Lacertae		"	09 46·04		46·78	....	....		10 02·83
	9	Bradley 2942		"	10 58·53		01·30	....	....		11 17·35
	10	B.A.C. 3495	L.C.,nr	"	16 34·14		25·43	41·88	16·45		....
	11	30 H.Camel	L.C.,nr	"	20 01·78		55·19	41·14	15·95	16·06	....
	12	B.D. 70·1240		"	23 25·11		27·52	....	....		23 43·58
	13	28 Cephei		"	25 44·55		48·68	....	....		26 04·74
	14	B.J. 848		"	27 19·94		20·99	37·07	16·08		27 37·05
	15	29 Cephei	r	"	28 48·28		52·43	....	....		29 08·49
	16	B.J. 851		"	33 16·49		19·33	....	....		33 35·39
	17	B.J. 852		"	34 58·62		59·34	15·49	16·15		35 15·40
	18	B.J. 855		"	36 44·51		44·71	00·76	16·05		37 00·77
	19	B.J. 858		"	39 49·90		50·70	06·78	16·08		40 06·76
	20	B.J. 859		"	41 57·55		57·96	14·01	16·05		42 14·02
t. 17	21	29 Vulp		N	20 34 13·49	·041	13·82	....	....	17·88	20 34 31·70
	22	B.J. 774		"	35 11·01	(·770)	11·27	29·13	17·86		35 29·15
	23	B.J. 777		"	38 04·26		05·09	23·01	17·92	17·89	38 22·98
	24	B.J. 778		"	38 59·07		59·31	17·11	17·80		39 17·20
	25	B.J. 780	r	"	42 17·18		17·75	35·62	17·87		42 35·64
	26	B.J. 784		"	43 37·00		37·62	55·54	17·92		43 55·51
	27	76 Draconis	nr	"	48 44·31		50·18	08·13	17·95		....
	28	220 H¹.Drac	nr	"	51 18·61		23·27	....	....		51 41·16
	29	B.J. 788		"	53 31·80		32·52	50·44	17·92		53 50·41
	30	Bradley 2748		"	55 27·64		30·78	....	....		55 48·67
	31	f^1 Cygni		"	56 28·45		29·35	....	....		56 47·24
	32	B.J. 792		"	21 01 22·10		22·89	40·83	17·94		21 01 40·78
	33	B.J. 793		"	02 34·95		35·62	53·47	17·85		02 53·51
	34	f^2 Cygni		"	03 12·53		13·43	....	....		03 31·32
	35	Groom. 3409		"	05 31·74		34·10	....	....		05 51·99
	36	B.J. 795		"	06 57·43		01·14	....	....		07 19·03
	37	B.J. 798		"	09 12·55		13·95	31·98	....		09 31·84
	38	B.J. 799	r	"	10 54·91		55·56	13·46	17·90		11 13·45
	39	v Cygni		"	13 56·14		56·72	....	....		14 14·61
	40	B.A.C. 7504	nr	"	16 04·14		17·90	35·65	17·75		....
	41	1 H.Draconis	L.C.,nr	"	24 09·98		04·78	22·97	18·19	17·90	....
	42	B.J. 807		"	25 50·45		51·32	09·23	....		26 09·22
	43	B.J. 809		"	27 11·22		13·46	....	....		27 31·36
	44	72 Cygni		"	30 49·09		49·76	....	....		31 07·66
	45	B.J. 811		"	33 03·46		04·17	22·14	17·97		33 22·07
	46	B.J. 813		"	35 52·41		53·68	11·61	....		36 11·58
	47	B.J. 817		"	40 17·54		19·88	....	....		40 37·78
	48	78 Draconis		"	41 39·52		42·00	....	....		41 59·90
	49	B.J. 821		"	43 10·87		11·83	29·73	....		43 29·73

Clamp East. 1—20. Adopted $\Delta T+m=16{\cdot}046+{\cdot}0142\ (T-21^h\ 40^m)$.
21—49. Adopted $\Delta T+m=17{\cdot}908+{\cdot}0147\ (T-22^h\ 10^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 17	1	14 Pegasi.....		N	21 45 35·25	·041	35·74	.....	....	17·90	21 45 53·64
	2	B.J. 823.......		"	48 41·56	(·770)	41·98	59·94	17·96		48 59·88
	3	79 Draconis...		"	51 24·96		27·65	.....	....		51 45·55
	4	Bradley 2897..	r	"	56 40·61		43·53	.....	....		57 01·43
	5	16 Cephei.....		"	57 39·05		41·65	.....	....		57 59·55
	6	B.J. 831.......		"	22 02 32·99		33·39	51·29	17·90	17·91	22 02 51·30
	7	B.J. 833.......	r	"	04 57·79		58·33	16·30	17·97		05 16·24
	8	B.J. 835.......		"	05 42·89		43·43	01·34	17·91		06 01·34
	9	B.J. 837.......		"	07 46·30		48·78	.....	....		08 06·69
	10	1 H.Lacertae..		"	09 44·19		44·88	.....	....		10 02·79
	11	B.A.C. 3495...	L.C.,nr	"	16 33·47		25·28	42·93	17·65		....
	12	30 H.Camel...	L.C.,nr	"	20 00·28		54·09	11·92	17·83		....
	13	B.D. 70·1240..		"	23 23·04		25·31	.....	....		23 43·22
	14	B.J. 847.......		"	25 32·51		33·82	51·70	....		25 51·73
	15	B.J. 848.......		"	27 18·06		19·04	36·98	....		27 36·95
	16	29 Cephei.....		"	28 46·17		50·07	.....	....		29 07·98
	17	226 B.Cephei..		"	30 22·98		26·15	.....	....		30 44·06
	18	B.J. 851.......		"	33 14·48		17·15	.....	....		33 35·06
	19	B.J. 852.......		"	34 56·83		57·51	15·43	17·92		35 15·42
	20	B.J. 855.......	r	"	36 42·66		42·83	00·73	17·90		37 00·74
	21	B.J. 857.......		"	38 30·73		31·22	49·13	17·91		38 49·13
	22	B.J. 858.......	r	"	39 48·01		48·75	06·72	17·97	17·92	40 06·67
	23	B.J. 859.......	r	"	41 55·73		56·10	13·97	17·87		42 14·02
	24	B.J. 862.......		"	45 23·46		23·86	41·78	17·92		45 41·78
	25	52 Pegasi.....		"	54 25·95		26·14	.....	....		54 44·06
	26	B.J. 869.......		"	57 30·19		30·94	48·98	18·04		57 48·86
	27	B.J. 870.......		"	59 08·53		08·98	26·93	17·95		59 26·90
	28	5 Andromedae		"	23 03 23·42		24·37	.....	....		23 03 42·29
	29	B.J. 874.......		"	04 44·20		47·19	.....	....		05 05·11
	30	B.J. 875.......		"	08 40·10		41·35	59·41	....		08 59·27
	31	Bradley 3085..		"	11 07·40		10·16	.....	....		11 28·08
	32	Bradley 3086..		"	11 51·92		54·19	.....	....		12 12·11
	33	Groom. 4033..		"	13 50·83		53·79	.....	....		14 11·71
	34	B.J. 880.......	r	"	15 54·96		55·33	13·29	17·96		16 13·25
	35	B.J. 881.......		"	20 37·32		37·68	55·61	17·93	17·93	20 55·61
	36	B.J. 885.......		"	24 20·52		20·73	38·65	17·92		24 38·66
	37	39 H. Cephei..	nr	"	27 24·85		39·23	57·27	18·04		....
	38	Bradley 3140..		"	30 47·29		49·66	.....	....		31 07·59
	39	B.J. 890.......		"	32 53·08		53·94	11·92	....		33 11·87
	40	Groom. 4119..		"	35 00·92		03·88	.....	....		35 21·81
	41	ψ Andromedae		"	41 17·94		18·80	.....	....		41 36·73
	42	B.J. 898.......		"	47 38·86		39·16	57·04	17·88		47 57·09
	43	B.J. 899......		"	49 36·49		37·76	55·81	....		49 55·69
	44	ψ Pegasi......		"	52 54·43		54·83	.....	....		53 12·76
Oct. 18	45	σ Cygni.......		S	21 13 35·31	·048	36·04	.....	....	18·23	21 13 54·27
	46	Bradley 2796..		"	16 20·72	(·772)	24·05	.....	....		16 42·28
	47	B.J. 804.......		"	17 38·74		39·08	57·27	18·19		17 57·31
	48	69 Cygni......		"	21 49·06		49·71	.....	....		22 07·94
	49	1 H.Draconis..	L.C.,nr	"	24 10·20		04·93	23·13	18·20		....

Clamp East.

1—44. Adopted $\Delta T+m=17{\cdot}908+{\cdot}0147$ ($T-22^h\ 10^m$).
45—49. Adopted $\Delta T+m=18{\cdot}258+{\cdot}0149$ ($T-23^h\ 05^m$).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 18	1	Groom. 3511..		S	21 27 07·77	·048	12·30	......	......	18·23	21 27 30·53
	2	ρ Cygni.......		"	30 18·16	(·772)	19·05	......	......		30 37·28
	3	B.J. 811.......		"	33 03·13		03·88	22·12	18·24	18·24	33 22·12
	4	B.J. 813.......		"	35 52·03		53·27	11·58	......		36 11·51
	5	B.J. 817.......		"	40 17·09		19·38	......	......		40 37·62
	6	78 Draconis...	r	"	41 39·07		41·64	......	......		41 59·88
	7	B.J. 821.......		"	43 10·47		11·40	29·71	......		43 29·64
	8	14 Pegasi.....		"	45 34·83		35·35	......	......		45 53·59
	9	B.J. 823.......		"	48 41·21		41·66	59·92	18·26		48 59·90
	10	Bradley 2868..		"	49 47·17		48·35	......	......		50 06·59
	11	79 Draconis...		"	51 24·66		27·30	......	......		51 45·54
	12	B.J. 826.......		"	56 25·93		26·18	44·38	18·20		56 44·42
	13	16 Cephei.....		"	57 38·78		41·34	......	......		57 59·58
	14	B.J. 831.......		"	22 02 32·61		33·05	51·27	18·22		22 02 51·29
	15	B.J. 833.......		"	04 57·41		57·99	16·28	18·29		05 16·23
	16	28 Pegasi.....		"	05 58·37		58·73	......	......		06 16·97
	17	B.J. 837.......		"	07 45·93		48·35	......	......		08 06·59
	18	1 H.Lacertae..		"	09 43·82		44·55	......	......		10 02·79
	19	Bradley 2942..		"	10 56·11		58·68	......	......		11 16·92
	20	B.A.C. 3495...	L.C.,nr	"	16 33·30		25·01	43·10	18·09	18·25	....
	21	30 H.Camel...	L.C.,nr	"	20 00·00		53·73	12·05	18·32		....
	22	B.D. 70·1240..		"	23 22·69		24·91	......	......		23 43·16
	23	38 Pegasi.....		"	25 37·99		38·57	......	......		25 56·82
	24	B.J. 848.......		"	27 17·71		18·66	36·96	......		27 36·91
	25	29 Cephei.....		"	28 45.90		49·72	......	......		29 07·97
	26	226 B. Cephei		"	30 22·58		25·69	......	......		30 43·94
	27	B.J. 851.......		"	33 14·24		16·87	......	......		33 35·12
	28	Groom. 3857..		"	34 58·43		01·36	......	......		35 19·61
	29	B.J. 855.......		"	36 42·26		42·47	00·72	18·25		37 00·72
	30	B.J. 857.......		"	38 30·33		30·86	49·11	18·25		38 49·11
	31	B.J. 858.......		"	39 47·61		48·39	06·70	18·31		40 06·64
	32	B.J. 859.......	r	"	41 55·32		55·68	13·96	18·28		42 13·93
	33	B.J. 862.......		"	45 23·07		23·50	41·77	18·27		45 41·75
	34	52 Pegasi.....	r	"	54 25·56		25·73	......	......	18·26	54 43·99
	35	B.J. 869.......	r	"	57 29·94		30·67	48·96	18·29		57 48·93
	36	B.J. 871.......		"	23 00 00·48		00·75	19·01	18·26		23 00 19·01
	37	5 Andromedae		"	03 23·06		23·98	......	......		03 42·24
	38	B.J. 874.......		"	04 43·80		46·73	......	......		05 04·99
	39	B.J. 875.......		"	08 39·82		41·04	59·39	......		08 59·30
	40	Bradley 3085..		"	11 07·02		09·74	......	......		11 28·00
	41	Groom. 4033..	r	"	13 50·31		53·40	......	......		14 11·66
	42	B.J. 880.......		"	15 54·60		55·01	13·28	18·27		16 13·27
	43	B.J. 881.......	r	"	20 37·01		37·36	55·61	18·25		20 55·62
	44	B.J. 885.......		"	24 20·15		20·39	38·64	18·25		24 38·65
	45	39 H.Cephei...	nr	"	27 25·33		39·88	57·11	17·23		....
	46	B.J. 890.......		"	32 52·77		53·61	11·91	......		33 11·87
	47	Groom. 4119..		"	35 00·64		03·55	......	......	18·27	35 21·82
	48	ψ Andromedae	r	"	41 17·65		18·56	......	......		41 36·83
	49	Groom. 4154..		"	47 43·51		46·48	......	......		48 04·75
	50	Groom. 4163..		"	50 09·30		12·05	......	......		50 30·32

Clamp East. 1—50. Adopted $\Delta T+m=18{\cdot}258+{\cdot}0149\ (T-23^h\ 05^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 18	1	ψ Pegasi......		S	23 52 54·08	·048	54·52	.....	....	18·27	23 53 12·79
	2	Bradley 3217..		"	0 04 03·98	(·772)	08·12	.....	....		0 04 26·39
	3	B.J. 7.........		"	08 20·05		20·32	38·65	18·33		08 38·59
	4	B.J. 8.........		"	10 49·78		53·06	.....	....		11 11·33
	5	σ Andromedae	r	"	13 21·11		21·71	.....	....		13 39·98
	6	ρ Andromedae		"	16 06·33		07·02	.....	....	18·28	16 25·30
	7	Bradley 34....		"	24 50·71		54·01	...	....		25 12·29
	8	B.J. 17........		"	31 40·74		41·83	00·20	....		32 00·11
	9	B.J. 21........		"	35 07·27		08·47	26·84	....		35 26·75
	10	B.J. 24........		"	39 24·98		27·84	....	....		39 46·12
	11	23 Cass.......	r	"	41 28·08		31·08	.....	....		41 49·36
	12	ν Andromedae		"	44 34·61		35·37	.....	....		44 53·65
	13	32[2] H.Camel..	L.C.,nr	"	48 08·92		01·74	19·83	18·09		....
	14	B.J. 33........		"	51 29·11		29·81	48·15	18·34		51 48·09
	15	h Piscium.....		"	52 41·72		42·22	.....	....		53 00·50
	16	43 H.Cephei...	nr	"	56 01·98		12·96	31·42	18·46	18·29	....
Oct. 19	17	B.J. 768.......		N	20 28 37·67	·036	37·84	56·44	18·60	18·60	20 28 56·44
	18	ζ Delphini....		"	30 48·86	(·751)	49·09	.....	....		31 07·69
	19	B.J. 771.......	r	"	33 02·59		02·81	21·34	18·53		33 21·41
	20	29 Vulp.......		"	34 12·78		13·11	.....	....		34 31·71
	21	B.J. 774.......		"	35 10·31		10·55	29·09	18·54		35 29·15
	22	B.J. 777.......		"	38 03·51		04·32	22·96	18·64		38 22·92
	23	B.J. 778.......		"	38 58·25		58·48	17·08	18·60		39 17·08
	24	B.J. 780.......		"	42 16·38		16·93	35·58	18·65		42 35·53
	25	B.J. 784.......	r	"	43 36·28		36·88	55·50	18·62		43 55·48
	26	76 Draconis...	nr	"	48 43·28		48·97	07·82	18·85	18·61	....
	27	220 H[1].Drac...	nr	"	51 17·69		22·20	.....	....		51 40·81
	28	B.J. 788.......		"	53 31·04		31·74	50·40	18·66		53 50·35
	29	Bradley 2748..		"	55 26·80		29·84	.....	....		55 48·45
	30	f[1] Cygni.......		"	56 27·69		28·56	.....	.....		56 47·17
	31	B.J. 792.......		"	21 01 21·31		22·08	40·79	18·71		21 01 40·69
	32	B.J. 793.......		"	02 34·21		34·85	53·43	18·58		02 53·46
	33	f[2] Cygni......		"	03 11·80		12·67	.....	....		03 31·28
	34	Groom. 3409..		"	05 30·94		33·23	.....	....		05 51·84
	35	B.J. 795.......		"	06 56·59		00·18	.....	....		07 18·79
	36	B.J. 798.......		"	09 11·83		13·18	31·90	....		09 31·79
	37	υ Cygni.......		"	13 55·35		55·92	.....	....		14 14·53
	38	Bradley 2796..		"	16 20·23		23·52	.....	....		16 42·13
	39	B.J. 804.......		"	17 38·36		38·66	57·25	18·59		17 57·27
	40	69 Cygni......		"	21 48·69		49·29	.....	....		22 07·90
	41	1 H.Draconis..	L.C.,nr	"	24 09·60		04·55	23·27	18·72		....
	42	B.J. 807......		"	25 49·74		50·58	09·18	....	18·62	26 09·20
	43	72 Cygni......		"	30 48·32		48·96	.....	....		31 07·58
	44	B.J. 811.......		"	33 02·78		03·46	22·10	18·64		33 22·08
	45	B.J. 813.......		"	35 51·66		52·89	11·55	....		36 11·51
	46	B.J. 817.......		"	40 16·61		18·88	.....	....		40 37·50
	47	78 Draconis...	r	"	41 38·76		41·16	.....	....		42 59·78
	48	B.J. 821.......		"	43 10·12		11·04	29·69	....		43 29·66
	49	14 Pegasi.....		"	45 34·50		34·97	.....	....		45 53·59

Clamp East.

1—16. Adopted $\Delta T+m=18{\cdot}258+{\cdot}0149\ (T-23^h\ 05^m)$.
17—49. Adopted $\Delta T+m=18{\cdot}620+{\cdot}0150\ (T-21^h\ 45^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 19	1	B.J. 823.......		N	21 48 40·85	·036	41·25	59·91	18·66	18·62	21 48 59·87
	2	Bradley 2868..		"	49 46·82	(·751)	47·99	.....	....		50 06·61
	3	13 Cephei.....	r	"	51 33·39		34·58	.....	....		51 53·20
	4	Bradley 2897..		"	56 39·66		42·49	.....	....		57 01·11
	5	16 Cephei.....	r	"	57 38·37		40·89	.....	....		57 59·51
	6	B.J. 831.......		"	22 02 32·19		32·58	51·26	18·68		22 02 51·20
	7	B.J. 833.......		"	04 57·10		57·63	16·27	18·64		05 16·25
	8	B.J. 835.......	r	"	05 42·17		42·70	01·31	18·61	18·63	06 01·33
	9	B.J. 837.......		"	07 45·44		47·84	.....	....		08 06·47
	10	1 H.Lacertae..		"	09 43·45		44·12	.....	....		10 02·75
	11	Bradley 2942..		"	10 55·70		58·24	.....	....		11 16·87
	12	B.A.C. 3495...	L.C.,nr	"	16 32·43		24·50	43·28	18·78		....
	13	30 H.Camel...	L.C.,nr	"	19 59·56		53·56	12·18	18·62		....
	14	B.D. 70·1240..		"	23 22·19		24·39	.....	....		23 43·02
	15	B.J. 847.......		"	25 31·67		32·94	51·65	....		25 51·57
	16	B.J. 848.......		"	27 17·28		18·23	36·94	....		27 36·86
	17	29 Cephei.....		"	28 45·35		49·14	.....	....		29 07·77
	18	226 B.Cephei..		"	30 22·31		25·39	.....	....		30 44·02
	19	B.J. 851.......		"	33 13·56		16·15	.....	....		33 34·78
	20	B.J. 852.......		"	34 56·03		56·68	15·40	18·72		35 15·31
	21	B.J. 855.......		"	36 41·92		42·09	00·71	18·62		37 00·72
	22	B.J. 857.......		"	38 29·99		30·46	49·10	18·64		38 49·09
	23	B.J. 858.......		"	39 47·28		47·99	06·68	18·69		40 06·62
	24	B.J. 859.......		"	41 54·97		55·33	13·95	18·62		42 13·96
	25	B.J. 862.......	r	"	45 22·78		23·16	41·76	18·60	18·64	45 41·80
	26	52 Pegasi.....	r	"	54 25·23		25·41	.....	....		54 44·05
	27	B.J. 869.......	r	"	57 29·54		30·27	48·95	18·68		57 48·91
	28	B.J. 870.......		"	59 07·87		08·30	26·91	18·61		59 26·94
	29	B.J. 875.......		"	23 08 39·44		40·65	59·37	....		23 08 59·29
	30	39 H.Cephei...	nr	"	27 24·66		38·61	56·96	18·35	18·65	....
Oct. 20	31	69 Cygni......		S	21 21 48·16	·055	48·82	.....	....	19·03	21 22 07·85
	32	1 H.Draconis..	L.C.,rn	"	24 09·72	(·772)	04·40	23·41	19·01		....
	33	Groom. 3511..		"	27 06·83		11·40	.....	....		27 30·43
	34	72 Cygni......		"	30 47·81		48·53	.....	....		31 07·56
	35	B.J. 811.......		"	33 02·29		03·05	22·08	19·03		33 22·08
	36	B.J. 813.......		"	35 51·19		52·44	11·52	....		36 11·47
	37	B.J. 817.......		"	40 16·24		18·56	.....	....		40 37·59
	38	78 Draconis...	r	"	41 38·13		40·73	.....	....		41 59·76
	39	14 Pegasi.....		"	45 34·00		34·53	.....	....		45 53·56
	40	B.J. 823.......		"	48 40·32		40·78	59·89	19·11		48 59·81
	41	Bradley 2868..		"	49 46·32		47·51	.....	....		50 06·54
	42	79 Draconis...		"	51 23·73		26·39	.....	....	19·04	51 45·43
	43	Bradley 2897..		"	56 39·29		42·18	.....	....		57 01·22
	44	16 Cephei.....	r	"	57 37·68		40·41	.....	....		57 59·45
	45	B.J. 831.......		"	22 02 31·75		32·19	51·24	19·05		22 02 51·23
	46	B.J. 833.......		"	04 56·57		57·16	16·25	19·09		05 16·20
	47	B.J. 835.......	r	"	05 41·69		42·22	01·29	19·07		06 01·26
	48	B.J. 837.......		"	07 44·92		47·37	.....	....		08 06·41
	49	1 H.Lacertae..		"	09 42·94		43·68	.....	....		10 02·72

Clamp East.

1—30. Adopted $\Delta T+m=18{\cdot}620+{\cdot}0150\ (T-21^h\ 45^m)$.
31—49. Adopted $\Delta T+m=19{\cdot}055+{\cdot}0151\ (T-23^h\ 10^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 20	1	Bradley 2942..		S	22 10 55·22	·055	57·81	......	......	19·04	22 11 16·85
	2	B.A.C. 3495...	L.C.,rn	"	16 32·69	(·772)	24·33	43·46	19·13		....
	3	30 H.Camel...	L.C.,rn	"	19 59·50		53·18	12·32	19·14		....
	4	52 Pegasi.....		"	54 24·75		24·97	......	......	19·05	54 44·02
	5	B.J. 869......		"	57 29·65		29·85	48·94	19·09		57 48·90
	6	B.J. 871.......		"	59 59·69		59·97	18·99	19·02		23 00 19·02
	7	5 Andromedae		"	23 03 22·28		23·21	......	......		03 42·26
	8	B.J. 874.......		"	04 42·99		45·95	......	......		05 05·00
	9	B.J. 875.......		"	08 39·03		40·26	59·35	......		08 59·31
	10	Bradley 3085..		"	11 06·22		08·96	......	......	19·06	11 28·02
	11	Groom. 4033..	r	"	13 49·39		52·50	......	......		14 11·56
	12	B.J. 880.......		"	15 53·81		54·23	13·26	19·03		16 13·29
	13	B.J. 881.......		"	20 36·15		36·56	55·59	19·03		20 55·62
	14	B.J. 885.......		"	24 19·31		19·55	38·63	19·08		24 38·61
	15	39 H. Cephei..	rn	"	27 23·85		38·52	56·80	18·28		....
	16	Bradley 3140..		"	30 46·24		48·59	......	......		31 07·65
	17	B.J. 890.......	r	"	32 51·86		52·77	11·89	......		33 11·83
	18	Groom. 4119..		"	34 59·85		02·79	......	......		35 21·85
	19	ψ Andromedae		"	41 16.90		17·74	......	......		41 36·80
	20	Groom. 4154..		"	47 42·71		45·70	......	......		48 04·76
	21	Groom. 4163..		"	50 08·38		11·15	......	......	19.07	50 30·22
	22	ψ Pegasi......		"	52 53·32		53·76	......	......		53 12·83
	23	Bradley 3217..		"	0 04 03·04		07·22	......	......		0 04 26·29
	24	B.J. 4.........		"	05 21·18		22·02	41·08	......		05 41·09
	25	B.J. 7.........		"	08 19·30		19·58	38·64	19·06		08 38·65
	26	B.J. 8.........		"	10 48·97		52·28	......	......		11 11·35
	27	σ Andromedae		"	13 20·30		20·96	......	......		13 40·03
	28	ρ Andromedae	r	"	16 05·70		06·34	......	......		16 25·41
	29	Bradley 34....		"	24 49·99		53·32	......	......		25 12·39
	30	B.J. 17........		"	31 39·99		41·09	00·09	......	19·08	32 00·17
	31	B.J. 20........		"	34 13·88		14·43	33·51	19·08		34 33·51
	32	B.J. 21........		"	35 06·41		07·62	26·83	......		35 26·70
	33	B.J. 24........		"	39 24·32		27·21	......	......		39 46·29
	34	B.D. 71·37....		"	41 58·34		00·83	......	......		42 19·91
	35	η Cassiopeiae..	r	"	43 22·22		23·57	......	......		43 42·65
	36	ν Andromedae		"	44 33·83		34·60	......	......		44 53·68
	37	B.J. 33........		"	51 28·38		29·09	48·16	19·07		51 48·17
	38	*h* Piscium.....		"	52 40·95		41·46	......	......		53 00·54
	39	43 H. Cephei..	rn	"	56 00·70		11·77	31·44	19·67		....
Oct. 21	40	13 Cephei.....		S	21 51 32·52	·062	33·77	......	......	19·40	21 51 53·17
	41	Bradley 2897..	r	"	56 38·58	(·793)	41·75	......	......		57 01·15
	42	16 Cephei.....		"	57 37·36		40·02	......	......		57 59·42
	43	B.J. 831.......		"	22 02 31·35		31·80	51·23	19·43	19·41	22 02 51·21
	44	B.J. 833.......	r	"	04 56·24		56·80	16·24	19·44		05 16·21
	45	28 Pegasi.....		"	05 57·17		57·55	......	......		06 16·96
	46	B.J. 837.......		"	07 44·58		47·12	......	......		08 06·53
	47	1 H.Lacertae..		"	09 42·57		43·34	......	......		10 02·75
	48	Bradley 2942..		"	10 54·70		57·39	......	......		11 16·80
	49	B.A.C. 3495...	L.C.,nr	"	16 32·73		24·06	43·65	19·59		....

Clamp East. 1—39. Adopted $\Delta T+m=19{\cdot}055+{\cdot}0151\ (T-23^h\ 10^m)$.
40—49. Adopted $\Delta T+m=19{\cdot}426+{\cdot}0152\ (T-23^h\ 25^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 21	1	30 H.Camel...	L.C.,nr	S	22 19 59·63	·062	53·08	12·47	19·39	19·41	....
	2	B.D. 70·1240..		"	23 21·35	(·793)	23·67	.....	....		22 23 43·08
	3	38 Pegasi.....		"	25 36·81		37·42	.....	....		25 56·83
	4	B.J. 848.......		"	27 16·40		17·41	36·90	....		27 36·82
	5	226 B. Cephei..		"	30 21·22		24·48	.....	....		30 43·89
	6	Groom. 3857..		"	34 57·06		00·13	.....	....		35 19·54
	7	B.J. 855.......	r	"	36 41·08		41·25	00·69	19·44		37 00·66
	8	B.J. 858.......	r	"	39 46·45		47·21	06·65	19·44		40 06·62
	9	B.J. 859.......	r	"	41 54·14		54·52	13 92	19·40	19·42	42 13·94
	10	B.J. 862.......		"	45 21·87		22·32	41·74	19·42		45 41·74
	11	52 Pegasi.....		"	54 24·32		24·56	.....	....		54 43·98
	12	B.J. 869.......		"	57 28·65		29·48	48·92	19·44		57 48·90
	13	B.J. 870.......		"	59 06·97		07·48	26·89	19·41		59 26·90
	14	5 Andromedae		"	23 03 21·82		22·79	.....	....		23 03 42·21
	15	B.J. 874.......	r	"	04 42·30		45·54	.....	....		05 04·96
	16	B.J. 875.......		"	08 38·50		39·78	59·33	....		08 59·20
	17	Bradley 3085..		"	11 05·60		08·44	.....	....		11 27·86
	18	Groom. 4033..		"	13 48·99		52·04	.....	....		14 11·46
	19	B.J. 880.......	r	"	15 53·45		53·83	13·26	19·43		16 13·25
	20	B.J. 881.......		"	20 35·74		36·16	55·59	19·43		20 55·58
	21	B.J. 885.......		"	24 18·94		19·19	38·62	19·43	19·43	24 38·62
	22	1 H. Cass.....		"	25 34·05		35·40	.....	....		25 54·83
	23	15Andromedae		"	29 55·41		56·19	.....	....		30 15·62
	24	B.J. 890.......		"	32 51·52		52·40	11·88	....		33 11·83
	25	κ Andromedae		"	35 40·51		41·40	.....	....		36 00·83
	26	ψ Andromedae	r	"	41 16·39		17·34	.....	....		41 36·77
	27	Groom. 4154..		"	47 42·07		45·17	.....	....		48 04·60
	28	Groom. 4163..		"	50 07·87		10·74	.....	....		50 30·17
	29	ψ Pegasi......		"	52 52·94		53·39	.....	....		53 12·82
	30	Bradley 3217..		"	0 04 02·49		06·82	.....	....	19·44	0 04 26·26
	31	B.J. 4.........		"	05 20·74		21·61	41·07	....		05 41·05
	32	B.J. 7.........		"	08 18·92		19·21	38·64	19·43		08 38·65
	33	B.J. 8.........		"	10 48·45		51·88	.....	....		11 11·32
	34	σ Andromeda	r	"	13 19·99		20·62	.....	....		13 40·06
	35	ρ Andromedae		"	16 05·18		05·90	.....	....		16 25·34
	36	Bradley 34....		"	24 49·48		52·93	.....	....		25 12·37
	37	B.J. 17........		"	31 39·50		40·64	00·18	....		32 00·08
	38	B.J. 19........		"	33 30·57		31·11	50·56	19·45		33 50·55
	39	B.J. 21........	r	"	35 06·07		07·41	26·82	....		35 26·85
	40	B.J. 25........		"	39 24·89		25·83	45·33	....		39 45·27
	41	23 Cass.......		"	41 26·91		29·86	.....	....	19·45	41 49·31
	42	η Cass........		"	43 21·83		23·15	.....	....		43 42·60
	43	ν Andromedae		"	44 33·44		34·24	.....	....		44 53·69
	44	32² H. Camel.	L.C.,nr	"	48 07·83		00·32	19·98	19·66		....
	45	B.J. 33........		"	51 27·98		28·71	48·16	19·45		51 48·16
	46	*h* Piscium.....		"	52 40·55		41·08	.....	....		53 00·53
	47	43 H. Cephei..	nr	"	56 00·26		11·72	31·43	19·71		....
Oct. 26	48	B.J. 768.......	....	N	20 28 34·66	·022	34·84	56·33	21·49	21·47	20 28 56·31
	49	ζ Delphini.....	....	"	30 45·87	(·818)	46·10	.....	....		31 07·57

Clamp East.

1—47. Adopted $\Delta T+m=19{\cdot}426+{\cdot}0152\ (T-23^{h}\ 25^{m})$.
48—49. Adopted $\Delta T+m=21{\cdot}488+{\cdot}0158\ (T-21^{h}\ 35^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Oct. 26	1	29 Vulp.......		N	20 34 09·80	·022	10·13	....	....	21·47	20 34 31·60
	2	B.J. 774.......		"	35 07·30	(·818)	07·55	28·98	21·43		35 29·02
	3	B.J. 777.......		"	38 00·46		01·32	22·78	21·46		38 22·79
	4	B.J. 778.......		"	38 55·30		55·53	16·97	21·44		39 17·00
	5	B.J. 780.......	r	"	42 13·37		13·95	35·44	21·49		42 35·42
	6	B.J. 784.......		"	43 33·18		33·81	55·36	21·55		43 55·28
	7	76 Draconis...		"	48 38·93		45·01	06·54	21·53	21·48	....
	8	220 H[1]. Drac..	nr	"	51 13·67		18·50	....	....		51 39·98
	9	B.J. 788.......		"	53 27·90		28·64	50·24	21·60		53 50·12
	10	Bradley 2748..		"	55 23·30		26·54	....	.....		55 48·02
	11	f^1 Cygni.......		"	56 24·59		25·51	.....	.....		56 46·99
	12	v Cygni.......		"	21 13 52·29		52·88	....	....		21 14 14·36
	13	B.J. 804.......		"	17 35·31		35·62	57·14	21·52		17 57·10
	14	69 Cygni......		"	21 45·64		46·27	.....	......		22 07·75
	15	1 H.Draconis..	L.C.	"	24 08·25		02·84	24·48	21·64	21·49	....
	16	B.J. 807.......		"	25 46·63		47·52	09·01	....		26 09·01
	17	B.J. 809.......		"	27 06·91		09·23	.....	....		27 30·72
	18	ρ Cygni.......		"	30 14·70		15·57	....	....		30 37·06
	19	B.J. 811.......		"	32 59·73		00·46	21·96	21·50		33 21·95
	20	B.J. 813.......		"	35 48·42		49·72	11·32	....		36 11·21
	21	B.J. 816.......	r	"	40 13·99		14·40	35·91	21·51		40 35·89
	22	B.J. 821.......		"	43 07·02		08·00	29·52	....		43 29·49
	23	14 Pegasi.....		"	45 31·42		31·92	.....	....		45 53·41
	24	B.J. 831.......		"	22 02 29·27		29·68	51·16	21·48	21·50	22 02 51·18
	25	B.J. 833.......	r	"	04 54·06		54·61	16·16	21·55		05 16·11
	26	B.J. 835.......		"	05 39·16		39·71	01·20	21·49		06 01·21
	27	B.J. 836.......		"	07 22·60		23·93	45·42	....		07 45·43
	28	1 H.Lacertae..		"	09 40·45		41·15	.....	....		10 02·65
	29	B.A.C. 3495...	L.C.,nr	"	16 31·81		23·30	44·86	21·56		....
	30	30 H.Camel...	L.C.,nr	"	19 58·47		52·04	13·39	21·35		....
	31	B.J. 847.......		"	25 28·60		29·96	51·46	....		25 51·46
	32	B.J. 848.......		"	27 14·27		15·28	36·80	....		27 36·78
	33	B.J. 852.......		"	34 53·13		53·81	15·29	21·48		35 15·31
	34	B.J. 855.......	r	"	36 39·00		39·17	00·64	21·47		37 00·67
Nov. 2	35	B.J. 836.......		N	22 07 19·64	·018	20·90	45·20	....	24·38	22 07 45·28
	36	1 H.Lacertae..		"	09 37·52	(·769)	38·18	.....	....		10 02·56
	37	Bradley 2942..		"	10 49·31		51·84	.....	....		11 16·22
	38	B.A.C. 3495...	L.C.,nr	"	16 29·45		21·52	46·43	24·91		....
	39	30 H.Camel...	L.C.,nr	"	19 56·00		50·00	14·57	24·57		....
	40	B.D. 70·1240..		"	23 15·96		18·15	.....	....		23 42·53
	41	B.J. 847.......		"	25 25·67		26·94	51·25	....		25 51·32
	42	B.J. 848.......		"	27 11·31		12·26	36·64	....	24·39	27 36·65
	43	29 Cephei.....		"	28 38·84		42·63	.....	....		29 07·02
	44	226 B.Cephei..		"	30 15·70		18·77	.....	....		30 43·16
	45	B.J. 851.......		"	33 07·34		09·93	.....	....		33 34·32
	46	B.J. 852.......		"	34 50·18		50·83	15·17	24·34		35 15·22
	47	B.J. 855.......		"	36 36·07		36·22	00·56	24·34		37 00·61
	48	B.J. 857.......		"	38 24·14		24·60	48·92	24·32		38 48·99
	49	B.J. 858.......		"	39 41·31		42·02	06·46	24·44		40 06·41

Clamp East.

1—34. Adopted $\Delta T+m=21{\cdot}488+{\cdot}0158\ (T-21^h\ 35^m)$.
35—49. Adopted $\Delta T+m=24{\cdot}408+{\cdot}0165\ (T-23^h\ 50^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Nov. 2	1	B.J. 859.......		N	22 41 49·09	·018	49·44	13·78	24·34	24·39	22 42 13·83
	2	B.J. 862.......	r	"	45 16·81	(·769)	17·18	41·60	24·42		45 41·57
	3	B.J. 869.......	r	"	57 23·62		24·34	48·75	24·41		57 48·73
	4	B.J. 870.......		"	59 01·97		02·39	26·75	24·36		59 26·78
	5	B.J. 871.......		"	59 54·31		54·52	18·87	24·35		23 00 18·91
	6	5 Andromedae		"	23 03 16·73		17·64	.....	....	24·40	03 42·04
	7	B.J. 874.......		"	04 36·85		39·75	.....	....		05 04·15
	8	B.J. 875.......		"	08 33·41		34·62	59·08	....		08 59·02
	9	Bradley 3085..		"	11 00·10		02·78	...	....		11 27·18
	10	Groom. 4033..	r	"	13 43·51		46·39	.....	....		14 10·79
	11	B.J. 880.......		"	15 48·37		48·72	13·15	24·43		16 13·12
	12	B.J. 881.......	r	"	20 30·69		31·03	55·49	24·46		20 55·43
	13	B.J. 885.......		"	24 13·96		14·14	38·54	24·40		24 38·54
	14	39 H.Cephei...	nr	"	27 15·36		29·33	53·51	24·18		....
	15	Bradley 3140..		"	30 40·35		42·64	.....	....		31 07·04
	16	B.J. 890.......		"	32 46·43		47·25	11·73	....		33 11·65
	17	κ Andromedae		"	35 35·48		36·25	.....	....		36 00·65
	18	ψ Andromedae		"	41 11·40		12·22	.....	....	24·41	41 36·63
	19	Groom. 4154..		"	47 36·75		39·69	.....	....		48 04·10
	20	Groom. 4163..		"	50 02·62		05·33	.....	....		50 29·74
	21	ψ Pegasi......		"	52 47·94		48·31	.....	....		53 12·72
	22	B.J. 1.........		"	0 03 21·70		22·14	46·55	24·41		0 03 46·55
	23	B.J. 2.........		"	03 59·26		00·56	25·07	....		04 24·97
	24	B.J. 4.........		"	05 15·66		16·47	40·98	....		05 40·88
	25	B.J. 7.........		"	08 13·94		14·15	38·60	24·45		08 38·56
	26	B.J. 8.........		"	10 43·15		46·39	.....	....		11 10·80
	27	Bradley 1672..	L.C.	"	14 05·63		42·33	06·79	24·46		....
	28	Bradley 34....		"	24 44·16		47·42	.....	....	24·42	25 11·84
	29	B.J. 18........		"	31 42·01		42·54	07·00	24·46		32 06·96
	30	B.J. 19........		"	33 25·63		26·07	50·54	24·47		33 50·49
	31	B.J. 20........		"	34 08·59		09·06	33·49	24·43		34 33·48
	32	B.J. 21........		"	35 01·11		02·30	26·75	....		35 26·72
	33	B.J. 24........		"	39 18·76		21·58	.....	....		39 46·00
	34	23 Cass.......	r	"	41 21·87		24·66	.....	....		41 49·08
	35	η Cass........		"	43 16·87		18·11	.....	....		43 42·53
	36	ν Andromedae		"	44 28·59		29·28	.....	....		44 53·70
	37	32² H. Camel.	L.C.,nr	"	48 03·43		56·56	20·78	24·22		....
	38	B.J. 33........		"	51 23·04		23·67	48·16	24·49		51 48·09
	39	*h* Piscium.....		"	52 35·67		36·11	.....	....	24·43	53 00·54
	40	43 H.Cephei...	nr	"	55 54·99		05·53	30·60	25·07		....
	41	72 Piscium....		"	59 58·35		58·56	.....	....		1 00 22·99
	42	μ Cass........		"	1 01 54·57		55·69	.....	....		02 20·12
	43	B.J. 42........		"	04 19·29		19·86	44·32	24·46		04 44·29
	44	B.J. 43........		"	06 20·00		20·46	44·94	24·48		06 44·89
	45	Bradley 151...		"	09 20·81		23·12	.....	....		09 47·55
Nov. 4	46	5 Andromedae		N	23 03 15·95	·049	16·81	.....	....	25·12	23 03 41·93
	47	B.J. 874.......		"	04 36·07	(·686)	38·79	.....	....		05 03·91
	48	B.J. 875.......		"	08 32·64		33·77	59·04	....		08 58·89
	49	Bradley 3086..		"	11 44·04		46·10	.....	....		12 11·22

Clamp East.

1–45. Adopted $\Delta T+m=24·408+·0165\ (T-23^h\ 50^m)$.
46–49. Adopted $\Delta T+m=25·129+·0168\ (T-23^h\ 40^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Nov. 4	1	o Cephei......		N	23 14 30·65	·049	32·44	.....	....	25·12	23 14 57·56
	2	B.J. 880.......		"	15 47·65	(·686)	48·00	13·13	25·13		16 13·12
	3	B.J. 881.......	r	"	20 30·00		30·34	55·47	25·13		20 55·46
	4	B.J. 885.......		"	24 13·19		13·38	38·52	25·14		24 38·50
	5	39 H.Cephei..	nr	"	27 14·75		27·78	53·03	25·25	25·13	....
	6	Bradley 3140..		"	30 39·53		41·68	.....	....		31 06·81
	7	B.J. 890.......		"	32 45·69		46·48	11·71	....		33 11·61
	8	B.J. 891.......		"	33 19·57		20·27	45·50	25·23		33 45·40
	9	B.J. 893.......		"	35 13·25		16·45	.....	....		35 41·58
	10	ψ Andromedae	r	"	41 10·67		11·46	.....	....		41 36·59
	11	B.J. 895.......	r	"	43 11·84		13·60	.....	....		43 38·73
	12	B.J. 898.......		"	47 31·58		31·86	56·94	25·08		47 56·99
	13	B.J. 899.......		"	49 29·14		30·29	55·55	....		49 55·42
	14	ψ Pegasi......		"	52 47·24		47·62	.....	....		53 12·75
	15	B.J. 1.........		"	0 03 20·96		21·40	46·54	25·14	25·14	0 03 46·54
	16	B.J. 7.........		"	08 13·28		13·51	38·59	25·08		08 38·65
	17	σ Andromedae		"	13 14·21		14·78	.....	....		13 39·92
	18	ρ Andromedae	r	"	15 59·50		00·10	.....	....		16 25·24
Nov. 8	19	B.J. 851.......		S	22 33 04·35	·055	06·97	.....	....	26·88	22 33 33·85
	20	B.J. 853.......		"	35 00·33	(·765)	01·91	.....	....		35 28·79
	21	B.J. 855.......		"	36 33·38		33·59	00·49	26·90		37 00·47
	22	B.J. 857.......		"	38 21·41		21·94	48·84	26·90		38 48·82
	23	B.J. 858.......	r	"	39 38·72		39·44	06·35	26·91		40 06·32
	24	B.J. 859.......		"	41 46·39		46·81	13·71	26·90		42 13·69
	25	B.J. 863.......		"	46 01·31		03·08	.....	....		46 29·96
	26	52 Pegasi.....	r	"	54 16·73		16·91	.....	....		54 43·79
	27	B.J. 869.......		"	57 20·88		21·68	48·65	26·97	26·89	57 48·57
	28	B.J. 871.......		"	59 51·66		51·94	18·81	26·87		23 00 18·83
	29	B.J. 874.......	r	"	23 04 33·86		36·98	.....	....		05 03·87
	30	B.J. 875.......		"	08 30·73		31·95	58·94	....		08 58·84
	31	Bradley 3085..		"	10 57·34		00·05	.....	....		11 26·94
	32	o Cephei.......		"	14 28·64		30·58	.....	....		14 57·47
	33	B.J. 880.......	r	"	15 45·83		46·19	13·09	26·90		16 13·08
	34	B.J. 881.......		"	20 28·12		28·53	55·43	26·90		20 55·42
	35	B.J. 885.......		"	24 11·37		11·61	38·49	26·88		24 38·50
	36	39 H. Cephei..	nr	"	27 10·86		25·40	51·78	26·38		....
	37	B.J. 890.......	r	"	32 43·80		44·71	11·65	....	26·90	33 11·61
	38	Groom. 4119..		"	34 51·02		53·93	.....	....		35 20·83
	39	B.J. 895.......		"	43 09·86		11·77	.....	....		43 38·67
	40	B.J. 898.......		"	47 29·64		29·98	56·91	26·93		47 56·88
	41	B.J. 899.......		"	49 27·27		28·51	55·48	....		49 55·41
	42	ψ Pegasi......		"	52 45·37		45·81	.....	....		53 12·71
	43	Bradley 3217..		"	0 03 54·22		58·36	.....	....		0 04 25·26
	44	B.J. 7.........		"	08 11·35		11·63	38·57	26·94	26·91	08 38·54
	45	B.J. 8.........		"	10 40·41		43·69	.....	....		11 10·60
	46	σ Andromedae		"	13 12·29		12·95	.....	....		13 39·86
	47	ρ Andromedae	r	"	15 57·71		58·35	.....	....		16 25·26
	48	Bradley 34....		"	24 41·52		44·82	.....	....		25 11·73
	49	B.J. 16........		"	27 27·30		28·84	.....	....		27 55·75

Clamp East

1—18. Adopted $\Delta T+m=25{\cdot}129+{\cdot}0168\ (T-23^h\ 40^m)$.

19—49. Adopted $\Delta T+m=26{\cdot}909+{\cdot}0172\ (T-0^h\ 20^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Nov. 8	1	B.J. 17........		S	0 31 32·03	·055	33·12	00·05	....	26·91	0 32 00·03
	2	B.J. 19........		"	33 23·07	(·765)	23·58	50·53	26·95		33 50·49
	3	B.J. 21........		"	35 58·57		59·77	26·69	....		36 26·68
	4	B.J. 24........	r	"	39 15·76		18·79	.....	....		39 45·70
	5	23 Cass.......		"	41 19·22		22·05	.....	....	26·92	41 48·97
	6	η Cass........	r	"	43 14·23		15·57	.....	....		43 42·49
	7	B.J. 29........	r	"	44 50·21		51·93	.....	....		45 18·85
	8	32^2 H.Camel..	L.C.,nr	"	48 01·46		54·28	21·34	27·06		....
	9	B.J. 32........		"	50 51·23		52·64	.....	....		51 19·56
	10	h Piscium.....		"	52 33·12		33·62	.....	....		53 00·54
	11	43 H.Cephei...	nr	"	55 51·70		02·68	30·00	27·32		....
	12	72 Piscium....		"	59 55·80		56·08	.....	....		1 00 23·00
	13	μ Cass........		"	1 01 52·18		53·31	.....	....		02 20·23
	14	B.J. 41........		"	04 03·17		07·31	.....	....		04 34·23
	15	χ Piscium.....		"	06 12·38		12·74	.....	....		06 39·66
	16	Bradley 137...	r	"	08 06·15		10·63	.....	....		08 37·55
	17	Bradley 155...		"	12 23·65		27·10	.....	....		12 54·02
	18	Bradley 166...		"	15 24·75		28·55	.....	....		15 55·47
	19	ξ Andromedae		"	16 37·52		38·40	.....	....	26·93	17 05·33
	20	B.J. 46........		"	19 09·23		11·17	.....	....		19 38·10
	21	α Urs. Min....	nr	"	26 43·75		23·41	51·05	27·64		....
	22	v Andromedae		"	31 06·02		06·80	.....	....		31 33·73
	23	τ Andromedae		"	34 51·26		52·01	.....	....		35 18·94
	24	B.J. 57........		"	37 36·34		37·32	04·30	....		38 04·25
	25	2 Persei.......	r	"	46 00·99		02·05	.....	....		46 28·98
	26	γ Arietis.		"	48 11·08		11·42	.....	....		48 38·35
	27	B.J. 66........		"	49 15·68		16·04	42·96	26·92		49 42·97
	28	λ Arietis......	r	"	52 30·38		30·74	.....	....	26·94	52 57·68
	29	48 Cass.......		"	54 08·84		11·08	.....	....		54 38·02
	30	B.J. 70........		"	55 19·99		22·43	.....	....		55 49·37
	31	Groom. 424...	rn	"	57 53·33		58·38	.....	....		58 25·32
	32	B.J. 74........		"	2 01 41·59		42·01	08·92	26·91		2 02 08·95
	33	Bradley 282...		"	04 38·77		41·46	.....	....		05 08·40
Nov. 9	34	14 Pegasi.....		N	21 45 25·61	·041	26·13	.....	....	27·15	21 45 53·28
	35	B.J. 823.......		"	48 31·96	(·822)	32·40	59·58	27·18		48 59·55
	36	Bradley 2868..	r	"	50 37·63		38·92	.....	....		51 06·07
	37	13 Cephei.....		"	51 24·08		25·38	.....	....		51 52·53
	38	Bradley 2897..		"	56 29·49		32·59	.....	....		56 59·74
	39	16 Cephei.....	r	"	57 28·33		31·10	.....	....		57 58·25
	40	B.J. 833.......	r	"	22 04 48·15		48·73	15·92	27·19	27·16	22 05 15·89
	41	B.J. 835.......		"	05 33·12		33·70	00·96	27·26		06 00·86
	42	B.J. 837.......		"	07 35·46		38·09	.....	....		08 05·25
	43	1 H.Lacertae..		"	09 34·49		35·22	.....	....		10 02·38
	44	B.A.C. 3495...	L.C.,rn	"	16 29·53		20·79	48·19	27·40		....
	45	30 H.Camel...	L.C.,rn	"	19 55·62		49·01	15·92	26·91		....
	46	B.D. 70·1240..		"	23 12·36		14·77	.....	....		23 41·93
	47	B.J. 847.......		"	25 22·43		23·82	51·04	....		25·50·98
	48	B.J. 848.......		"	27 08·24		09·28	36·47	....		27 36·44
	49	226 B.Cephei..		"	30 11·88		15·26	.....	....		30 42·42

Clamp East.

1—33. Adopted $\Delta T+m=26·909+·0172$ (T-0^h 20^m).
34—49. Adopted $\Delta T+m=27·177+·0173$ (T-23^h 20^m).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Nov. 9	1	B.J. 851.......		N	22 33 03·85	·041	06·69	.....	....	27·16	22 33 33·85
	2	B.J. 852.......		"	34 47·18	(·822)	47·90	15·05	27·15		35 15·06
	3	B.J. 855.......	r	"	36 33·12		33·30	00·48	27·18		37 00·46
	4	B.J. 857.......		"	38 21·17		21·69	48·82	27·13		38 48·85
	5	B.J. 858.......	r	"	39 38·32		39·10	06·33	27·23	27·17	40 06·27
	6	B.J. 859.......	r	"	41 46·18		46·57	13·69	27·12		42 13·74
	7	B.J. 862.......		"	45 13·93		14·35	41·51	27·16		45 41·52
	8	52 Pegasi......		"	54 16·46		16·66	.....	....		54 43·83
	9	B.J. 869.......		"	57 20·55		21·35	48·63	27·28		57 48·52
	10	B.J. 870.......		"	58 58·99		59·47	26·67	27·20		59 26·64
	11	B.J. 871.......		"	59 51·43		51·68	18·79	27·11		23 00 18·85
	12	5 Andromedae		"	23 03 13·68		14·69	.....	....		03 41·86
	13	B.J. 874.......	r	"	04 33·44		36·62	.....	....		05 03·79
	14	B.J. 875.......		"	08 30·29		31·62	58·92	....		08 58·79
	15	Bradley 3085..		"	10 56·80		59·74	.....	....		11 26·91
	16	Bradley 3086..		"	11 41·61		44·03	.....	....		12 11·20
	17	Groom. 4033..		"	13 40·16		43·31	.....	....	27·18	14 10·49
	18	B.J. 880.......	r	"	15 45·51		45·90	13·07	27·17		16 13·08
	19	B.J. 881.......		"	20 27·82		28·21	55·42	27·21		20 55·39
	20	B.J. 885.......		"	24 11·09		11·31	38·48	27·17		24 38·49
	21	39 H.Cephei...	rn	"	27 09·61		24·93	51·42	26·49		....
	22	15 Androm....		"	29 47·47		48·21	.....	....		30 15·39
	23	B.J. 890.......		"	32 43·51		44·43	11·63	....		33 11·61
	24	B.J. 891.......		"	33 17·47		18·29	45·43	27·14		33 45·47
	25	κ Andromedae		"	35 32·52		33·37	.....	....		36 00·55
	26	ψ Andromedae	r	"	41 08·54		09·46	.....	....		41 36·64
	27	B.J. 895.......		"	43 09·37		11·43	.....	....		43 38·61
	28	Groom. 4154..		"	47 33·43		36·65	.....	....		48 03·83
	29	Groom. 4163..		"	49 59·36		02·34	.....	....	27·19	50 29·53
	30	ψ Pegasi......		"	52 45·10		45·53	.....	....		53 12·72
	31	B.J. 1.........		"	0 03 18·76		19·26	46·50	27·24		0 03 46·45
	32	B.J. 2.........		"	03 56·34		57·77	24·94	....		04 24·96
	33	B.J. 4.........		"	05 12·81		13·72	40·91	....		05 40·91
	34	B.J. 7.........		"	08 11·12		11·37	38·56	27·19		08 38·56
	35	B.J. 8.........		"	10 39·94		43·50	.....	....		11 10·69
	36	σ Andromedae	r	"	13 12·14		12·80	.....	....		13 39·99
	37	ρ Andromedae		"	15 57·38		58·07	.....	....		16 25·26
	38	Bradley 34....		"	24 40·91		44·49	.....	....	27·20	25 11·69
	39	B.J. 16........	r	"	27 26·92		28·59	.....	....		27 55·79
	40	B.J. 17........		"	31 31·60		32·78	00·04	....		31 59·98
	41	B.J. 19........		"	33 22·82		23·32	50·51	27·19		33 50·52
	42	B.J. 20........		"	34 05·73		06·26	33·46	27·20		34 33·46
	43	B.J. 21........		"	34 58·22		59·52	26·68	....		35 26·72
	44	B.J. 24........	r	"	39 15·46		18·56	.....	....		39 45·76
	45	23 Cass.......		"	41 18·77		21·83	.....	....		41 49·03
	46	B.J. 27........		"	42 09·14		09·55	36·67	27·12		42 36·75
	47	η Cass.........		"	43 13·95		15·31	.....	....		43 42·51
	48	ν Andromedae		"	44 25·70		26·47	.....	....		44 53·67
	49	32² H.Camel..	L.C.,rn	"	48 02·11		54·53	21·46	26·93		....
	50	B.J. 33........		"	51 20·22		20·92	48·13	27·21		51 48·12

Clamp East. 1—50. Adopted $\Delta T+m=27\cdot177+\cdot0173\ (T-23^h\ 20^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Nov. 9	1	h Piscium		N	0 52 32·87	·041	33·36	....	....	27·20	0 53 00·56
	2	43 H.Cephei	rn	"	55 51·08	(·822)	02·64	29·85	27·21		....
Nov. 20	3	38 Pegasi		S	22 25 56·98	−·038	57·42	....	....	−1·10	22 25 56·32
	4	B.J. 848		"	27 36·53	(·709)	37·28	36·19	....		27 36·18
	5	29 Cephei		"	29 02·82		06·04	....	....		29 04·94
	6	226 B.Cephei		"	30 40·07		42·67	....	....		30 41·57
	7	B.J. 851		"	33 31·95		34·13	....	....		33 33·03
	8	Groom. 3857		"	35 16·07		18·52	....	....		35 17·42
	9	B.J. 855	r	"	37 01·43		01·52	00·35	−1·17		37 00·42
	10	B.J. 857		"	38 49·37		49·76	48·65	−1·11		38 48·66
	11	B.J. 858		"	40 06·58		07·19	06·12	−1·07		40 06·09
	12	B.J. 859		"	42 14·33		14·63	13·54	−1·09		42 13·53
	13	B.J. 863		"	46 29·12		30·56	....	....		46 29·46
	14	52 Pegasi		"	54 44·63		44·77	....	....		54 43·67
	15	B.J. 869	r	"	57 48·90		49·47	48·43	−1·04		57 48·37
	16	B.J. 871		"	23 00 19·55		19·73	18·67	−1·06		23 00 18·63
	17	5 Andromedae		"	03 42·02		42·74	....	....		03 41·64
	18	B.J. 874	r	"	05 01·49		04·12	....	....		05 03·02
	19	B.J. 875		"	08 58·71		59·69	58·63	....		08 58·59
	20	Bradley 3085		"	11 25·17		27·43	....	....		11 26·33
	21	Groom. 4033		"	14 08·40		10·83	....	....		14 09·73
	22	B.J. 880	r	"	16 13·80		14·05	12·95	−1·10		16 12·95
	23	B.J. 882		"	20 51·92		53·13	....	....		20 52·03
	24	B.J. 885		"	24 39·33		39·49	38·36	−1·13		24 38·39
	25	39 H.Cephei	rn	"	27 36·47		48·93	47·84	−1·09		....
	26	B.J. 890	r	"	33 11·83		12·55	11·45	....		33 11·45
	27	κ Andromedae		"	36 00·85		01·52	....	....		36 00·42
	28	ψ Andromedae		"	41 36·87		37·52	....	....		41 36·42
	29	B.J. 895		"	43 37·82		39·38	....	....		43 38·28
	30	Groom. 4154		"	48 01·82		04·30	....	....		48 03·20
	31	Groom. 4163		"	50 27·77		30·06	....	....		50 28·96
	32	ψ Pegasi		"	53 13·36		13·69	....	....	−1·11	53 12·58
	33	Bradley 3217		"	0 04 21·84		25·32	....	....		0 04 24·21
	34	B.J. 7		"	08 39·41		39·59	38·48	−1·11		08 38·48
	35	σ Andromedae	r	"	13 40·47		40·92	....	....		13 39·81
	36	ρ Andromedae		"	16 25·72		26·26	....	....		16 25·15
Nov. 27	37	B.A.C. 3495	L.C.,nr	S	22 17 01·05	−·041	54.30	52·95	−1·35	−1·49	....
	38	30 H.Camel	L.C.,nr	"	20 26·08	(·684)	20·97	19·55	−1·42		....
	39	Groom. 4033		"	23 14 08·52		10·85	....	....		23 14 09·36
	40	B.J. 880		"	16 14·06		14·34	12·86	−1·48		16 12·85
	41	B.J. 882		"	20 52·03		53·18	....	....		20 51·69
	42	B.J. 885		"	24 39·69		39·84	38·29	−1·55		24 38·35
	43	1 H.Cass		"	25 54·56		55·55	....	....		25 54·06
	44	15Andromedae		"	30 16·14		16·69	....	....		30 15·20
	45	B.J. 890		"	33 12·22		12·84	11·32	....		33 11·35
	46	ψ Andromedae	r	"	41 37·05		37·73	....	....		41 36·24
	47	B.J. 895		"	43 37·97		39·47	....	....		43 37·98
	48	Groom. 4154		"	48 01·91		04·29	....	....	−1·50	48 02·79

From Nov. 9 Clamp East; from Nov. 20 Clamp West.

1— 2. Adopted $\Delta T+m=27\cdot177+\cdot0173$ (T−23^{h} 20^{m}).

3—36. Adopted $\Delta T+m=-1\cdot104-\cdot0022$ (T−23^{h} 25^{m}).

37—48. Adopted $\Delta T+m=-1\cdot496-\cdot0022$ (T−0^{h} 15^{m}).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Nov. 27	1	Groom. 4163..	r	S	23 50 27·69	−·041	30·04	.....	....	−1·50	23 50 28·54
	2	ψ Pegasi......		"	53 13·72	(·684)	14·02	.....	....		53 12·52
	3	Bradley 3217..		"	0 04 21·97		25·30	.....	....		0 04 23·80
	4	B.J. 4.........		"	05 41·50		42·12	40·65	....		05 40·62
	5	B.J. 7.........		"	08 39·75		39·93	38·42	−1·51		08 38·43
	6	B.J. 8.........		"	11 08·39		11·02	.....	....		11 09·52
	7	σ Andromedae	r	"	13 40·84		41·27	.....	....		13 39·77
	8	ρ Andromedae		"	16 26·04		26·56	.....	....		16 25·06
	9	Bradley 34....		"	25 09·65		12·29	.....	....		25 10·79
	10	B.J. 16........	r	"	27 55·55		56·84	.....	....		27 55·34
	11	B.J. 17........		"	32 00·41		01·23	59·78	....		31 59·73
	12	B.J. 20........		"	34 34·42		34·81	33·34	−1·47		34 33·31
	13	B.J. 25........		"	39 45·83		46·49	45·04	....		39 44·99
	14	B.D. 71·37....		"	42 18·76		20·72	.....	....		42 19·22
	15	η Cass........		"	43 42·79		43·75	.....	....		43 42·25
	16	ν Andromedae		"	44 54·37		54·94	.....	....		44 53·44
	17	32^2 H.Camel..	L.C.,nr	"	48 31·10		25·25	23·86	−1·39		....
	18	B.J. 32........		"	51 19·61		20·70	.....	....		51 19·20
	19	*h* Piscium.....		"	53 01·55		01·91	.....	....		53 00·41
	20	43 H.Cephei...	nr	"	56 19·01		27·99	26·92	−1·07		....
	21	72 Piscium....		"	1 00 24·25		24·43	.....	....		1 00 22·93
	22	μ Cass........		"	02 20·72		21·58	.....	....		02 20·08
	23	B.J. 41........	r	"	04 31·20		34·78	.....	....		04 33·28
	24	χ Piscium		"	06 40·84		41·09	.....	....		06 39·59
	25	Bradley 151...		"	09 46·78		48·64	.....	....		09 47·14
	26	Bradley 155...		"	12 52·12		54·89	.....	....		12 53·39
	27	B.J. 45........		"	14 35·00		35·33	33·87	−1·46		14 33·83
	28	*l* Piscium.....		"	16 12·63		12·99	.....	....		16 11·49
	29	B.J. 46........		"	19 37·79		39·31	.....	....		19 37·81
	30	ω Andromedae		"	22 19·93		20·59	.....	....		22 19·09
	31	α Urs. Min....	nr	"	27 11·46		44·10	42·22	−1·88		....
	32	υ Andromedae		"	31 34·69		35·27	.....	....		31 33·77
	33	τ Andromedae	r	"	35 19·98		20·47	.....	....		35 18·97
	34	B.J. 57........	r	"	38 04·85		05·65	04·23	....		38 04·15
	35	2 Persei.......		"	46 29·81		30·55	.....	....		46 29·05
	36	B.J. 63........		"	47 58·99		00·23	.....	....		47 58·73
Dec. 5	37	B.J. 7.........		N	0 08 39·07	−·073	39·21	38·35	−0·86	−0·90	0 08 38·31
	38	Bradley 1672..	L.C.	"	14 45·07	(·751)	24·19	23·92	−0·27		....
	39	Bradley 34....		"	25 08·52		11·40	.....	....	−0·89	25 10·51
	40	B.J. 16........		"	27 54·81		56·11	.....	....		27 55·22
	41	B.J. 18........		"	32 07·15		07·56	06·74	−0·82		32 06·67
	42	B.J. 19........		"	33 50·89		51·23	50·29	−0·94		33 50·34
	43	B.J. 20........		"	34 33·66		34·03	33·26	−0·77		34 33·14
	44	B.J. 24........		"	39 43·25		45·74	.....	....	−0·88	39 44·86
	45	23 Cass.......	r	"	41 46·35		48·81	.....	....		41 47·93
	46	η Cass........		"	43 41.93		42·98	.....	....		43 42·10
	47	ν Andromedae		"	44 53·65		54·21	.....	....		44 53·33
	48	32^2 H.Camel..	L.C.,nr	"	48 32·19		26·02	25·22	−0·80		....
	49	B.J. 33........		"	51 48·37		48·87	47·93	−0·94		51 47·99

Clamp West.

1—36. Adopted $\Delta T+m=-1{\cdot}496-{\cdot}0022\ (T-0^h\ 15^m)$.
37—49. Adopted $\Delta T+m=-0{\cdot}855+{\cdot}0300\ (T-1^h\ 35^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Dec. 5	1	*h* Piscium		N	0 53 00.90	−·073	01·24			−0·88	0 53 00·36
	2	43 H.Cephei	nr	"	56 16·72	(·751)	26·17	25·34	−0·83	−0·87	....
	3	72 Piscium		"	1 00 23·58		23·72				1 00 22·85
	4	μ Cass		"	02 19·90		20·83				02 19·96
	5	B.J. 42		"	04 44·55		45·00	44·15	−0·85		04 44·13
	6	B.J. 43		"	06 45·30		45·66	44·82	−0·84		06 44·79
	7	Bradley 137		"	08 33·71		37·42				08 36·55
	8	Bradley 151		"	09 45·84		47·86				09 46·99
	9	B.J. 45		"	14 34·36		34·67	33·82	−0·85		14 33·80
	10	*l* Piscium		"	16 12·00		12·34			−0·86	16 11·48
	11	ξ Andromedae		"	17 05·33		05·98				17 05·12
	12	B.J. 48		"	19 58·38		59·54	58·63	−0·86		19 58·68
	13	ω Andromedae		"	22 19·35		20·00				22 19·14
	14	α Urs. Min.		"	27 02·77		37·11	37·33	0·22		....
	15	ν Andromedae		"	31 34·03		34·59				31 33·73
	16	B.J. 55		"	35 43·33		44·98			−0·85	35 44·13
	17	B.J. 57		"	38 04·27		05·06	04·16			38 04·21
	18	2 Persei	r	"	46 29·15		29·95				46 29·10
	19	B.J. 64		"	48 00·41		00·76	59·96	−0·80		47 59·91
	20	B.J. 66		"	49 43·58		43·80	42·95	−0·85		49 42·95
	21	48 Cass		"	54 37·07		39·00				54 38·15
	22	B.J. 70		"	55 48·03		50·13			−0·84	55 49·29
	23	B.J. 73		"	58 25·83		26·42	25·57	−0·85		58 25·58
	24	B.J. 75		"	2 04 14·75		15·19	14·34	−0·85		2 04 14·35
	25	15 Arietis		"	05 41·93		42·13				05 41·29
	26	B.J. 77		"	07 40·83		41·64	40·55			07 40·80
	27	B.J. 79		"	12 01·37		01·79	00·93	−0·86		12 00·95
	28	B.J. 81		"	13 10·76		10·96	10·16	−0·80		13 10·12
	29	ι Cass		"	21 42·62		44·23			−0·83	21 43·40
	30	B.J. 87		"	29 32·50		34·67				29 33·84
	31	B.J. 89		"	33 46·06		46·30	45·46	−0·84		33 45·47
	32	B.J. 92		"	37 08·96		10·61			−0·82	37 09·79
	33	B.J. 93		"	38 07·03		07·79	06·80			38 06·97
	34	39 Arietis		"	42 36·74		37·08				42 36·26
	35	B.J. 100		"	44 44·96		45·27	44·42	−0·85		44 44·45
	36	σ Arietis		"	46 35·32		35·46				46 34·64
	37	B.J. 103		"	47 56·55		57·42	56·44			47 56·60
	38	B.J. 108		"	58 20·71		21·60	20·68		−0·81	58 20·79
	39	B.J. 109		"	59 28·45		28·96	28·09	−0·87		59 28·15
Dec. 8	40	B.J. 902		S	23 54 42·34	·074	42·55	43·63	1·08	1·12	23 54 43·67
	41	B.J. 13		"	0 25 28·11	(·782)	28·29	29·28	0·99	1·14	0 25 29·43
	42	B.J. 17		"	31 57·27		58·42	59·56			31 59·56
	43	B.J. 24		"	39 40·23		43·29				39 44·43
	44	32² H.Camel.	L.C.,nr	"	48 32·43		24·58	25·78	1·20	1·15	....
	45	43 H.Cephei	nr	"	56 11·50		23·37	24·55	1·18		....
	46	Bradley 155		"	1 12 47·83		51·55			1·16	1 12 52·71
	47	Bradley 166		"	15 48·83		52·91				15 54·07
	48	ξ Andromedae		"	17 03·03		03·95				17 05·11
	49	B.J. 48		"	19 55·95		57·42	58·57			19 58·58

Clamp West.

1—39. Adopted $\Delta T+m=-0{\cdot}855+{\cdot}0300$ (T−1ʰ 35ᵐ).
40—49. Adopted $\Delta T+m=1{\cdot}165+{\cdot}0300$ (T− 1ʰ 25ᵐ).

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Dec. 8	1	ω Andromedae		S	1 22 16·89	·074	17·81			1·16	1 22 18·97
	2	α Urs. Min....	nr	"	26 50·37	(·782)	33·48	34·76	1·28	1·17	....
	3	π Piscium.....		"	32 20·96		21·24				32 22·41
	4	42 Cass.......		"	35 56·93		59·28				36 00·45
	5	B.J. 57........		"	38 01·97		03·00	04·12			38 04·17
	6	2 Persei.......	r	"	46 26·65		27·76			1·18	46 28·94
	7	B.J. 64........		"	47 58·22		58·78	59·94	1·16		47 59·96
	8	B.J. 66........		"	49 41·36		41·77	42·94	1·17		49 42·95
	9	Bradley 246...		"	53 49·88		53·70				53 54·88
	10	Groom. 422...		"	55 12·43		15·28				55 16·46
	11	B.J. 74........		"	2 02 07·33		07·79	08·93	1·14		2 02 08·97
	12	15 Arietis.....		"	05 39·64		40·03			1·19	05 41·22
	13	B.J. 76........		"	07 26·00		27·92				07 29·11
	14	B.J. 79........		"	11 59·13		59·78	00·91	1·13		12 00·97
	15	B.J. 81........		"	13 08·56		08·95	10·15	1·20		13 10·14
	16	ξ Arietis......		"	20 01·14		01·40				20 02·59
	17	27 Arietis.....		"	25 56·37		56·73			1·20	25 57·93
	18	B.J. 87........		"	29 29·50		32·18				29 33·38
	19	B.J. 93........		"	38 04·65		05·63	06·79			38 06·83
	20	39 Arietis.....		"	42 34·55		35·10				42 36·30
	21	B.J. 99........		"	44 09·41		10·65	11·82			44 11·85
	22	σ Arietis......		"	46 33·08		33·40			1·21	46 34·61
	23	B.J. 103.......		"	47 54·15		55·26	56·43			47 56·47
	24	B.J. 109.......		"	59 26·12		26·88	28·09	1·21		59 28·09
Dec. 9	25	B.J. 16........		N	0 27 51·65	·022	53·30			1·80	0 27 55·10
	26	B.J. 17........		"	31 56·62	(·829)	57·79	59·54			31 59·59
	27	B.J. 19........		"	33 47·90		48·40	50·25	1·85		33 50·20
	28	B.J. 21........		"	35 22·91		24·20	26·13			35 26·00
	29	B.J. 25........		"	39 42·19		43·14	44·85		1·81	39 44·95
	30	B.D. 71·37....		"	42 14·26		16·95				42 18·76
	31	η Cass.........		"	43 38·80		40·14				43 41·95
	32	ν Andromedae		"	44 50·72		51·47				44 53·28
	33	32² H.Camel...	L.C.,nr	"	48 31·27		23·47	25·97	2·50		....
	34	B.J. 32........		"	51 15·68		17·19				...51 19·00
	35	h Piscium.....		"	52 58·00		58·49				52 00·30
	36	43 H.Cephei...	nr	"	56 09·99		21·79	24·30	2·51		....
	37	μ Cass........		"	1 02 16·79		18·00			1·82	1 02 19·82
	38	B.J. 41........		"	04 26·18		30·72				04 32·54
	39	B.J. 43........		"	06 42·39		42·90	44·78	1·88		06 44·72
	40	Bradley 137...		"	08 28·97		33·62				08 35·44
	41	Bradley 151...		"	09 42·11		44·67				09 46·49
	42	B.J. 45........		"	14 31·50		31·95	33·79	1·84		14 33·77
	43	l Piscium......		"	16 09·21		09·70				16 11·52
	44	ξ Andromedae		"	17 02·44		03·31				17 05·13
	45	B.J. 48........		"	19 55·31		56·80	58·55		1·83	19 58·63
	46	ω Andromedae		"	22 16·41		17·28				22 19·11
	47	α Urs. Min....		"	26 48·76		31·64	33·91	2·27		....
	48	B.J. 51........		"	31 18·20		20·95				31 22·78
	49	B.J. 55........		"	35 40·07		42·16				35 43·99

Clamp West.

1–24. Adopted $\Delta T+m=1\cdot165+\cdot0300\ (T-1^h\ 25^m)$.

25—49. Adopted $\Delta T+m=1\cdot838+\cdot0300\ (T-1^h\ 45^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R.A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Dec. 9	1	B.J. 57	r	N	1 38 01·23	·022	02·26	04·10		1·83	1 38 04·09
	2	2 Persei		"	46 26·00	(·829)	27·04			1·84	46 28·88
	3	B.J. 63		"	47 55·09		56·80				47 58·64
	4	B.J. 66		"	49 40·73		41·08	42·93	1·85		49 42·92
	5	48 Cass		"	54 33·50		35·94				54 37·78
	6	B.J. 70		"	55 44·33		46·99				55 48·83
	7	B.J. 73		"	58 22·93		23·72	25·54	1·82		58 25·56
	8	B.J. 74		"	2 02 06·70		07·10	08·92	1·82	1·85	2 02 08·95
	9	B.J. 75	r	"	04 11·81		12·42	14·32	1·90		04 14·27
	10	15 Arietis	r	"	05 38·99		39·32				05 41·17
	11	B.J. 77		"	07 37·61		38·66	40·51			07 40·51
	12	B.J. 79		"	11 58·49		59·08	00·91	1·83		12 00·93
	13	B.J. 81		"	13 07·94		08·27	10·15	1·88		13 10·12
	14	ι Cass	r	"	21 39·14		41·18			1·86	21 43·04
	15	27 Arietis		"	25 55·75		56·05				25 57.91
	16	B.J. 87		"	29 28·83		31·56				29 33·42
	17	B.J. 89		"	33 43·22		43·59	45·45	1·86		33 45·45
	18	B.J. 92		"	37 05·86		07·94				37 09·80
	19	B.J. 93		"	38 04·04		05·03	06·78			38 06·89
	20	39 Arietis		"	42 33·90		34·40			1·87	42 36·27
	21	B.J. 99		"	44 08·75		10·01	11·81			44 11·88
	22	σ Arietis		"	46 32·52		32·78				46 34·65
	23	B.J. 103		"	47 53·54		54·66	56·42			47 56·53
	24	B.J. 108		"	58 17·63		18·78	20·67			58 20·65
	25	B.J. 109		"	59 25·64		26·34	28·09	1·75	1·88	59 28·22
Dec. 10	26	B.J. 895		S	23 43 32·68	·043	34·78			2·60	23 43 37·38
	27	Groom. 4163	r	"	50 22·04	(·843)	25·25				50 27·85
	28	ψ Pegasi		"	53 09·29		09·77				53 12·37
	29	B.J. 1		"	0 03 43·02		43·57	46·17	2·60	2·61	0 03 46·18
	30	B.J. 4		"	05 36·94		37·84	40·42			05 40·45
	31	B.J. 8		"	11 02·51		06·16				11 08·77
	32	σ Andromedae		"	13 36·24		36·95				13 39·56
	33	ρ Andromedae	r	"	16 21·61		22·29				16 24·90
	34	Bradley 34		"	25 03·76		07·43			2·62	25 10·05
	35	B.J. 17		"	31 55·76		56·94	59·52			31 59·56
	36	B.J. 20		"	34 30·01		30·60	33·20	2·60		34 33·22
	37	B.J. 25		"	39 41·37	−·048	42·20	44·83			39 44·82
	38	B.D. 71·37		"	42 13·44	(·843)	15·87			2·63	42 18·50
	39	ν Andromedae		"	44 49·96		50·65				44 53·28
	40	32² H.Camel	L.C.,rn	"	48 31·01		23·75	26·16	2·41		....
	41	h Piscium		"	52 57·24		57·68				53 00·31
	42	43 H.Cephei	rn	"	56 09·99		21·03	24·06	3·03		....
	43	Bradley 109		"	1 01 26·96		31·22			2·64	1 01 33·86
	44	χ Piscium		"	06 36·51		36·81				06 39·45
	45	Bradley 137	r	"	08 28·25		32·72				08 35·36
	46	ω Andromedae		"	22 15·54		16·35			2·65	22 19·00
	47	α Urs. Min	rn	"	26 51·16		31·26	33·11	1·85		....
	48	π Piscium		"	32 19·59		19·76				32 22·41
	49	τ Andromedae		"	35 15·51		16·20				35 18·85
	50	B.J. 57	r	"	38 00·49		01·47	04·09			38 04·12

Clamp West.

1—25. Adopted $\Delta T+m=1\cdot838+\cdot0300\ (T-1^h\ 45^m)$.
26—50. Adopted $\Delta T+m=2\cdot650+\cdot0300\ (T-1^h\ 30^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Dec. 10	1	2 Persei.......		S	1 46 25·44	—·048	26·36	.....	....	2·66	1 46 29·02
	2	B.J. 64........		"	47 56·81	(·843)	57·26	59·93	2·67		47 59·92
	3	48 Cass.......		"	54 32·72		34·92	.....	....		54 37·58
	4	47 Cass.......		"	56 04·82		08·18	.....	....		56 10·84
	5	Bradley 282...		"	2 05 02·62		05·28	.....	....	2·67	2 05 07·95
	6	B.J. 76........		"	07 24·62		26·37	.....	....		07 29·04
	7	B.J. 79........		"	11 57·70		58·24	00·90	2·66		12 00·91
	8	B.J. 81........		"	13 07·15		07·44	10·14	2·70		13 10·11
	9	ξ Arietis......		"	19 59·78		59·92	.....	....		20 02·59
	10	27 Arietis.....	r	"	25 54·97		55·17	.....	....	2·68	25 57·85
	11	B.J. 87........		"	29 28·26		30·72	.....	....		29 33·40
	12	Bradley 344...	rn	"	34 47·16		52·32	.....	....		34 55·00
	13	B.J. 92........		"	37 05·06		06·93	.....	....		37 09·61
	14	B.J. 94........		"	38 10·32		10·74	13·42	2·68		38 13·42
	15	39 Arietis.....		"	42 33·08		33·52	.....	....	2·69	42 36·21
	16	B.J. 99........		"	44 07·95		09·06	11·81	....		44 11·75
	17	σ Arietis......		"	46 31·65		31·86	.....	....		46 34·55
	18	B.J. 103.......		"	47 52·77		53·76	56·42	....		47 56·45
	19	B.J. 105.......		"	54 07·79		11·86	.....	....		54 14·55
	20	Bradley 396...	rn	"	57 44·91		50·10	.....	....		57 52·79
	21	B.J. 109.......		"	59 24·77		25·42	28·09	2·67		59 28·11
	22	Bradley 417...		"	3 02 11·46		14·20	.....	....	2·70	3 02 16·90
	23	Groom. 2283..	L.C.,rn	"	05 39·17		20·85	24·38	3·53		....
	24	τ Arietis......		"	16 02·14		02·45	.....	....		16 05·15
	25	B.J. 120.......		"	17 54·37		55·26	57·88	....		17 57·96
	26	Bradley 459...		"	21 00·62		02·96	.....	....	2·71	21 05·67
Dec. 12	27	B.J. 27........		N	0 42 31·91	—·020	32·24	36·43	4·19	4·17	0 42 36·41
	28	η Cass........		"	43 36·62	(·767)	37·79	.....	....		43 41·96
	29	ν Andromedae		"	44 48·49		49·13	.....	....		44 53·30
	30	32² H.Camel..	L.C.,rn	"	48 28·96		22·13	26·54	4·41		....
	31	B.J. 33........		"	51 42·99		43·57	47·84	4·27		51 47·74
	32	h Piscium.....		"	52 55·75		56·15	.....	....	4·18	53 00·33
	33	43 H.Cephei...	rn	"	56 08·75		19·15	23·62	4·47		....
	34	Bradley 109...		"	1 01 25·58		29·71	.....	....		1 01 33·89
	35	B.J. 42........		"	04 39·38		39·90	44·07	4·17		04 44·08
	36	χ Piscium.....		"	06 35·06		35·33	.....	....		06 39·51
	37	Bradley 137...		"	08 27·43		31·52	.....	....		08 35·70
	38	Bradley 151...		"	09 39·91		42·15	.....	....		09 46·33
	39	B.J. 45........		"	14 29·17		29·54	33·76	4·22	4·19	14 33·73
	40	Bradley 166...		"	15 45.90		49·57	.....	....		15 53·76
	41	B.J. 46........		"	19 31·32		33·16	.....	....		19 37·35
	42	ω Andromedae		"	22 14·00		14·75	.....	....		22 18·94
	43	α Urs. Min....		"	26 46·89		24·68	31·63	6·95		....
	44	υ Andromedae		"	31 28·75		29·40	.....	....		31 33·59
	45	τ Andromedae	r	"	35 13·99		14·61	.....	....	4·20	35 18·81
	46	B.J. 57........		"	37 58·96		59·86	04·06	....		38 04·06
	47	2 Persei.......	r	"	46 23·71		24·62	.....	....		46 28·82
	48	B.J. 63........		"	47 52·78		54·27	.....	....		47 58·47
	49	B.J. 66........		"	49 38·47		38·74	42·91	4·17		49 42·94

Clamp West.

1—26. Adopted $\Delta T+m=2{\cdot}650+{\cdot}0300\ (T-1^{h}\ 30^{m})$.
27—49. Adopted $\Delta T+m=4{\cdot}204+{\cdot}0300\ (T-1^{h}\ 50^{m})$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Continued

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Dec. 12	1	λ Arietis......		N	1 52 53·14	−·020	53·46	.....	....	4·21	1 52 57·67
	2	Bradley 246...		"	53 46·92	(·767)	50·35	.....	....		53 54·56
	3	B.J. 70........		"	55 42·20		44·53	.....	....		55 48·74
	4	B.J. 73........		"	58 20·60		21·27	25·52	4·25		58 25·48
	5	B.J. 74........		"	2 02 04·40		04·72	08·91	4·19		2 02 08·93
	6	B.J. 75........		"	04 09·60		10·12	14·30	4·18		04 14·33
	7	15 Arietis.....		"	05 36·79		37·05	.....	....		05 41·26
	8	B.J. 77........		"	07 35·43		36·35	40·48	....		07 40·56
	9	B.J. 79........	r	"	11 56·17		56·67	00·89	4·22		12 00·88
	10	B.J. 81........	r	"	13 05·65		05·91	10·14	4·23	4·22	13 10·13
	11	ι Cass.........		"	21 37·09		38·87	.....	....		21 43·09
	12	27 Arietis.....		"	25 53·50		53·74	.....	....		25 57·96
	13	B.J. 87........		"	29 26·69		29·09	.....	....		29 33·31
	14	B.J. 89........		"	33 40·97		41·27	45·45	4·18	4·23	33 45·50
	15	B.J. 92........	r	"	37 03·44		05·26	.....	....		37 09·49
	16	B.J. 93........		"	38 01·69		02·54	06·77	....		38 06·77
	17	39 Arietis.....		"	42 31·65		32·06	.....	....		42 36·29
	18	B.J. 100.......		"	44 39·82		40·20	44·41	4·21		44 44·43
	19	σ Arietis......		"	46 30·12		30·32	.....	....		46 34·55
	20	B.J. 103.......		"	47 51·20		52·18	56·41	....		47 56·41
	21	B.J. 105.......		"	54 06·25		10·20	.....	....	4·24	54 14·44
	22	B.J. 108.......		"	58 15·45		16·44	20·65	....		58 20·68
	23	B.J. 109.......		"	59 23·26		23·85	28·09	4·24		59 28·09
	24	B.J. 111.......		"	3 02 17·48		18·12	22·37	4·25		3 02 22·36
	25	Groom. 2283..	L.C.,nr	"	05 36·36		19·15	24·80	5·65		....
Dec. 21	26	α Urs. Min....		N	1 26 47·08	−·022	25·08	23·94	−1·14	−1·39	....
	27	υ Andromedae	r	"	31 34·38	(·773)	35·03	.....	....		1 31 33·64
	28	B.J. 52........		"	32 31·44		32·28	30·76	....		32 30·89
	29	τ Andromedae		"	35 19·51		20·14	.....	....		35 18·75
	30	B.J. 57........	r	"	38 04·44		05·34	03·92	....	−1·38	38 03·96
	31	2 Persei.......		"	46 29·25		30·16	.....	....		46 28·78
	32	B.J. 64........		"	48 00·90		01·32	59·84	−1·48		47 59·94
	33	B.J. 66........		"	49 44·03		44·31	42·85	−1·46		49 42·93
	34	λ Arietis......		"	52 58·68		59·00	.....	....		52 57·62
	35	B.J. 70........		"	55 47·45		49·79	.....	....		55 48·41
	36	B.J. 73........		"	58 26·18		26·86	25·43	−1·43		58 25·48
	37	B.J. 74........		"	2 02 09·90		10·22	08·85	−1·37		2 02 08·84
	38	B.J. 75........	r	"	04 15·05		15·56	14·23	−1·33		04 14·18
	39	15 Arietis.....	r	"	05 42·28		42·54	.....	....		05 41·16
	40	B.J. 76........		"	07 28·44		30·16	.....	....		07 28·78
	41	B.J. 79........		"	12 01·75		02·24	00·83	−1·41		12 00·86
	42	B.J. 81........		"	13 11·18		11·44	10·09	−1·35		13 10·06
	43	ξ Arietis......		"	20 03·80		03·94	.....	....		20 02·56
	44	ι Cass	r	"	21 42·45		44·24	.....	....		21 42·86
	45	27 Arietis.....		"	25 59·07		59·30	.....	....		25 57·92
	46	B.J. 87........		"	29 31·95		34·36	.....	....		29 32·98
	47	B.J. 89........		"	33 46·52		46·82	45·41	−1·41		33 45·44
	48	B.J. 92........		"	37 08·89		10·72	.....	....		37 09·34
	49	B.J. 94........		"	38 14·38		14·77	13·37	−1·40		38 13·39
	50	39 Arietis.....		"	42 37·23		37·65	.....	....		42 36·27

Clamp West.

1—25. Adopted $\Delta T+m=4{\cdot}204+{\cdot}0300\ (T-1^h\ 50^m)$.
26—50. Adopted $\Delta T+m=-1{\cdot}376+{\cdot}0075\ (T-2^h\ 50^m)$.

TABLE III.

REDUCTION OF TRANSITS OBSERVED WITH THE MERIDIAN CIRCLE—Concluded

Date	Reference No.	Object	Notes	Observer	Time of Observed Transit	Coll. (Polar Dev.)	Sec. of Transit Corrected	R. A. of Known Stars	Apparent $\Delta T+m$	Adopted $\Delta T+m$	App. R.A. from Observation
1910					h. m. s.	s.	s.	s.	s.	s.	h. m. s.
Dec. 21	1	B.J. 100.......		N	2 44 45·42	−·022	45·80	44·37	−1·43	−1·38	2 44 44·42
	2	σ Arietis......		"	46 35·72	(·773)	35·91	.....	....		46 34·53
	3	B.J. 103.......		"	47 56·84		57·82	56·34	....		47 56·44
	4	B.J. 105.......		"	54 11·16		15·13	.....	....		54 13·75
	5	B.J. 108.......		"	58 21·01		22·01	20·59	....	−1·37	58 20·64
	6	B.J. 109.......		"	59 28·86		29·46	28·06	−1·40		59 28·09
	7	B.J. 111.......		"	3 02 23·04		23·69	22·34	−1·35		3 02 22·32
	8	Groom. 2283..	L.C.	"	05 45·38		28·07	26·82	−1·25		....
	9	B.J. 122.......		"	21 51·49		52·78	51·45	....		21 51·41
	10	B.J. 124.......		"	24 18·32		19·14	17·78	....		24 17·77
	11	s Tauri........		"	25 33·79		33·94	.....	....		25 32·57
	12	B.J. 129.......		"	34 25·57		27·06	.....	....		34 25·69
	13	11 Tauri......		"	35 28·29		28·64	.....	....		35 27·27
	14	B.J. 131.......		"	36 35·65		36·46	35·15	....		36 35·09
	15	B.J. 132.......		"	38 44·90		45·37	44·18	−1·19		38 44·00
	16	B.J. 136.......		"	39 36·37		36·70	35·40	−1·30		39 35·33
	17	B.J. 139.......	r	"	42 12·65		12·98	11·63	−1·35		42 11·61
	18	B.J. 144.......		"	48 32·99		33·46	32·23	−1·23		48 32·09
	19	B.J. 145.......		"	49 32·80		34·15	.....	....		49 32·78
	20	B.J. 147.......		"	51 53·56		54·18	52·86	−1·32		51 52·81
	21	B.J. 148.......		"	53 12·23		12·76	11·41	−1·35		53 11·39
	22	B.J. 150.......		"	55 46·37		46·54	45·08	−1·46		55 45·17

Clamp West. 1—22. Adopted $\Delta T+m=-1{\cdot}376+{\cdot}0075\ (T-2^h\ 50^m)$.

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0

Date	Clamp	Observer	Mean R.A. 1910·0
B. J. 296 Dec. 33° 38′			
			h m s
Mar. 18	W	N	7 41 42·37
Δ_1			−·003
Δ_2			−·003
Mean R.A.			7 41 42·364
B. J. 314 Dec. 43° 29′			
Mar. 18	W	N	8 16 40·66
Δ_1			−·002
Δ_2			−·005
Mean R.A.			8 16 40·653
B. J. 320 Dec. 38° 20′			
Mar. 17	W	S	8 27 04·13
18	W	N	04·16
Mean			04·145
Δ_1			−·005
Δ_2			−·002
Mean R.A.			8 27 04·138
B. J. 323 Dec. 53° 02′			
Mar. 17	W	S	8 32 37·85
18	W	N	37·94
Mean			37·895
Δ_1			−·003
Δ_2			−·005
Mean R.A.			8 32 37·887
B. J. 335 Dec. 48° 24′			
Mar. 17	W	S	8 53 03·04
Δ_1			−·003
Δ_2			−·001
Mean R.A.			8 53 03.036
B. J. 339 Dec. 42° 08′			
			h m s
Mar. 17	W	S	8 54 48·14
18	W	N	48·02
Mean			48·080
Δ_1			·004
Δ_2			−·002
Mean R.A.			8 54 48·082
B. J. 341 Dec. 47° 31′			
Mar. 17	W	S	8 57 29·17
18	W	N	29·15
Mean			29·160
Δ_1			−·004
Δ_2			−·003
Mean R.A.			8 57 29·153
B. A. C. 3097 Dec. 38° 49′			
Mar. 17	W	S	9 00 48·51
18	W	N	48·52
Mean			48·515
Δ_1			·000
Δ_2			−·002
Mean R.A.			9 00 48·513
B. J. 346 Dec. 43° 35′			
Mar. 17	W	S	9 07 55·30
18	W	N	55·38
Mean			55·340
Δ_1			−·004
Δ_2			−·003
Mean R.A.			9 07 55·333
B. J. 349 Dec. 37° 11′			
			h m s
Mar. 17	W	S	9 13 14·87
18	W	N	14·90
Mean			14·885
Δ_1			·000
Δ_2			−·002
Mean R.A.			9 13 14·883
B. J. 352 Dec. 34° 46′			
Apr. 28	W	N	9 15 34·61
Δ_1			·004
Δ_2			−·003
Mean R.A.			9 15 34·611
B. J. 358 Dec. 52° 05′			
Mar. 17	W	S	9 26 50·64
18	W	N	50·72
Apr. 2	W	S	50·59
10	E	S	50·70
11	E	N	50·69
14	E	S	50·68
21	E	N	50·59
22	W	N	50·60
28	W	N	50·77
Mean			50·664
Δ_1			−·004
Δ_2			−·001
Mean R.A.			9 26 50·659
B. J. 360 Dec. 36° 48′			
Mar. 17	W	S	9 28 42·88
Apr. 2	W	S	42·81
10	E	S	42·86
11	E	N	42·83
14	E	S	42·80
21	E	N	42·83
22	W	N	42·79
28	W	N	42·82
Mean			42·828
Δ_1			−·004
Δ_2			·000
Mean R.A.			9 28 42·824

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B. J. 368
Dec. 59° 28′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Mar. 17	W	S	9 44 35·94
18	W	N	35.91
Apr. 2	W	S	35·90
3	E	S	35·99
10	E	S	36·00
11	E	N	35·95
14	E	S	35·93
21	E	N	35·97
28	W	N	35·98
Mean			35·952
Δ_1			·001
Δ_2			·001
Mean R.A.			9 44 35·954

B. J. 374
Dec. 41° 29′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar. 17	W	S	9 52 10·58
18	W	N	10.61
Apr. 2	W	S	10.60
3	E	S	10.63
10	E	S	10.63
11	E	N	10.63
14	E	S	10·55
21	E	N	10·59
22	W	N	10·58
28	W	N	10·62
Mean			10·602
Δ_1			−·001
Δ_2			·000
Mean R.A.			9 52 10·601

B. J. 379
Dec. 17° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 30	W	S	10 02 25·73
Δ_1			·001
Δ_2			·003
Mean R.A.			10 02 25·734

B.J. 383
Dec. 43° 22′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Mar. 17	W	S	10 11 40·44
18	W	N	40·39
26	W	S	40·45
Apr. 2	W	S	40·51
3	E	S	.40·43
10	E	S	40·44
11	E	N	40·41
13	E	S	40·45
14	E	S	40·49
21	E	N	40·43
22	W	N	40·46
28	W	N	40.44
Mean			40·445
Δ_1			−·002
Δ_2			·000
Mean R.A.			10 11 40·443

B. J. 384
Dec. 23° 52′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 30	W	S	10 11 41·24
Δ_1			−·001
Δ_2			·002
Mean R.A.			10 11 41·241

B. J. 386
Dec. 41° 57′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar. 18	W	N	10 16 58·31
26	W	S	58·36
Apr. 30	W	S	58·33
Mean			58·333
Δ_1			·003
Δ_2			−·001
Mean R.A.			10 16 58·335

B. J. 390
Dec. 37° 10′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Mar. 18	W	N	10 22 40·98
Apr. 3	E	S	40·95
10	E	S	41·00
11	E	N	40·95
13	E	S	41·01
21	E	N	40·98
22	W	N	40·98
25	W	S	40·98
28	W	N	40·90
30	W	S	41·00
Mean			40·973
Δ_1			−·002
Δ_2			·000
Mean R.A.			10 22 40·971

B. J. 394
Dec. 56° 27′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar. 17	W	S	10 24 52·52
18	W	N	52·41
26	W	S	52·40
Apr. 3	E	S	52·42
10	E	S	52·52
11	E	N	52·51
13	E	S	52·47
21	E	N	52·36
22	W	N	52·45
25	W	S	52·51
28	W	N	52·42
30	W	S	52·53
Mean			52·460
Δ_1			−·003
Δ_2			·000
Mean R.A.			10 24 52·457

B. J. 398
Dec. 57° 33′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar. 17	W	S	10 29 22·30
18	W	N	22·32
26	W	S	22·27
Apr. 2	W	S	22·28

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

Date	Clamp	Observer	Mean R.A. 1910·0
B. J. 398 (continued)			
			h m s
Apr. 3	E	S	10 29 22·28
10	E	S	22·33
11	E	N	22·40
13	E	S	22·29
14	E	S	22·32
21	E	N	22·27
22	W	N	22·28
25	W	S	22·35
28	W	N	22·22
Mean			22·301
Δ_1			·003
Δ_2			·000
Mean R.A.			10 29 22·304
37 Leonis Minoris Dec. 32° 27′			
Mar. 26	W	S	10 33 39·52
Apr. 2	W	S	39·56
3	E	S	39·53
10	E	S	39·54
13	E	S	39·53
14	E	S	39·56
21	E	N	39·48
22	W	N	39·52
25	W	S	39·54
28	W	N	39·49
30	W	S	39·54
May 10	W	N	39·52
Mean			39·528
Δ_1			·000
Δ_2			·000
Mean R.A.			10 33 39·528
B. J. 405 Dec. 23° 40′			
Apr. 30	W	S	10 38 31·50
May 10	W	N	31·50
Mean			31·500
Δ_1			−·001
Δ_2			·000
Mean R.A.			10 38 31·499

Date	Clamp	Observer	Mean R.A. 1910·0
B. J. 407 Dec. 31° 09′			
			h m s
Mar. 26	W	S	10 40 51·82
Apr. 3	E	S	51·81
10	E	S	51·81
11	E	N	51·85
13	E	S	51·77
14	E	S	51·79
22	W	N	51·80
25	W	S	51·82
28	W	N	51·86
30	W	S	51·81
May 10	W	N	51·83
Mean			51·815
Δ_1			·004
Δ_2			·000
Mean R.A.			10 40 51·819
B. J. 412 Dec. 34° 42′			
Mar. 26	W	S	10 48 16·91
Apr. 3	E	S	16·96
10	E	S	16·86
11	E	N	16·91
13	E	S	16·91
14	E	S	16·92
21	E	N	16·95
22	W	N	16·93
25	W	S	16·92
28	W	N	16·94
30	W	S	16·93
May 10	W	N	16·86
Mean			16·917
Δ_1			·004
Δ_2			·000
Mean R.A.			10 48 16·921
54 Leonis Dec. 25° 14′			
Apr. 30	W	S	10 50 44·56
May 3	W	N	44·56
10	W	N	44·56
Mean			44·560
Δ_1			−·005
Δ_2			−·001
Mean R.A.			10 50 44·554

Date	Clamp	Observer	Mean R.A. 1910·0
47 Ursae Majoris Dec. 40° 55′			
			h m s
Mar. 26	W	S	10 54 25·83
Apr. 3	E	S	25·74
11	E	N	25·78
13	E	S	25·74
21	E	N	25·78
22	W	N	25·82
25	W	S	25·78
28	W	N	25·80
30	W	S	25·75
May 3	W	N	25·81
10	W	N	25·79
12	W	N	25·84
Mean			25·788
Δ_2			−·001
Mean R.A.			10 54 25·787
B. J. 416 Dec. 56° 52′			
Mar. 17	W	S	10 56 24·99
26	W	S	24·95
Apr. 3	E	S	25·04
10	E	S	25·07
11	E	N	25·08
13	E	S	25·05
14	E	S	25·04
21	E	N	25·08
22	W	N	25·07
25	W	S	25·06
28	W	N	25·08
30	W	S	25·00
May 3	W	N	25·16
10	W	N	25·04
12	W	N	25·07
Mean			25·052
Δ_1			−·003
Δ_2			−·001
Mean R.A.			10 56 25·048
B. J. 420 Dec. 44° 59′			
Mar. 26	W	S	11 04 36·42
Apr. 2	W	S	36·41
3	E	S	36·45
10	E	S	36·43

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B. J. 420 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Apr. 11	E	N	11 04 36·53
13	E	S	36·49
14	E	S	36·47
21	E	N	36·48
22	W	N	36·50
25	W	S	36·43
28	W	N	36·47
30	W	S	36·47
May 3	W	N	36·52
10	W	N	36·46
12	W	N	36·49

Mean 36·468
Δ_1 ·004
Δ_2 ·000

Mean R.A. 11 04 36·472

B. J. 422
Dec. 21° 01′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 30	W	S	11 09 19·42
May 3	W	N	19·43
7	W	S	19·43
10	W	N	19·41
12	W	N	19·41

Mean 19·420
Δ_1 −·005
Δ_2 ·000

Mean R.A. 11 09 19·415

B. J. 424
Dec. 49° 58′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar. 26	W	S	11 11 37·87
Apr. 2	W	S	37·80
3	E	S	37·77
10	E	S	37·85
11	E	N	37·93
14	E	S	37·86
22	W	N	37·81
25	W	S	37·89
28	W	N	37·94
30	W	S	37·81
May 3	W	N	37·91
7	W	S	37·81
10	W	N	37·86
12	W	N	37·77

B. J. 424 (continued)

	h m s
Mean	11 11 37·849
Δ_1	·003
Δ_2	−·001

Mean R.A. 11 11 37·851

B. J. 425
Dec. 33° 35′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar. 26	W	S	11 13 37·31
Apr. 2	W	S	37·23
11	E	N	37·20
14	E	S	37·25
21	E	N	37·20
22	W	N	37·26
25	W	S	37·30
28	W	N	37·17
30	W	S	37·20
May 3	W	N	37·25
7	W	S	37·23
10	W	N	37·36
12	W	N	37·21

Mean 37·244
Δ_1 ·003
Δ_2 −·001

Mean R.A. 11 13 37·246

B. J. 432
Dec. 43° 40′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 30	W	S	11 25 39·08
May 7	W	S	39·12
11	W	S	39·09

Mean 39·097
Δ_1 ·003
Δ_2 −·001

Mean R.A. 11 25 39·099

B. J. 441
Dec. 48° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Mar. 26	W	S	11 41 18·07
Apr. 2	W	S	18·02
25	W	S	18·13
27	W	S	18·14
30	W	S	18·12
May 7	W	S	18·06
10	W	N	18·08
11	W	S	18·09
12	W	N	18·13
15	W	S	18·08
16	E	N	18·09

Mean 18·092
Δ_1 −·001
Δ_2 −·002

Mean R.A. 11 41 18·089

B.J. 444
Dec. 15° 05′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 30	W	S	11 44 28·20
May 5	W	S	28·19
7	W	S	28·21
10	W	N	28·20
11	W	S	28·18
12	W	N	28·21
15	W	S	28·23
16	E	N	28·21

Mean 28·204
Δ_1 −·004
Δ_2 ·001

Mean R.A. 11 44 28·201

Groombridge 1830
Dec. 38° 22′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 2	W	S	11 47 47·64
12	E	N	47·76
25	W	S	47·70
27	W	S	47·76
May 3	W	N	47·78
5	W	S	47·65
7	W	S	47·73

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

Groombridge 1830 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 10	W	N	11 47 47·68
11	W	S	47·66
12	W	N	47·69
15	W	S	47·66
16	E	N	47·71
Mean			47·702
Δ_1			·003
Δ_2			–·001
Mean R.A.			11 47 47·704

B.J. 447
Dec. 54°12′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar 26	W	S	11 49 06·00
Apr. 12	E	N	06·09
25	W	S	06·09
27	W	S	06·09
May 7	W	S	06·04
11	W	S	06·03
12	W	N	06·13
15	W	S	06·03
16	E	N	06·16
Mean			06·073
Δ_1			·003
Δ_2			–·002
Mean R.A.			11 49 06·074

***o* Leonis**
Dec. 16° 09′

Date	Clamp	Observer	Mean R.A. 1910·0
May 3	W	N	11 51 02·90
5	W	S	02·85
7	W	S	02·86
10	W	N	02·94
11	W	S	02·88
12	W	N	02·89
15	W	S	02·84
16	E	N	02·84
Mean			02·875
Δ_2			·001
Mean R.A.			11 51 02·876

1 Canum Venaticorum
Dec. 53° 56′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Mar. 26	W	S	12 10 15·96
Apr. 27	W	S	16·01
May 3	W	N	15·96
5	W	S	15·81
7	W	S	15·88
10	W	N	15·91
11	W	S	15·96
12	W	N	15·95
15	W	S	15·91
16	E	N	15·85
21	E	N	15·92
Mean			15·920
Δ_2			–·003
Mean R.A.			12 10 15·917

B.J. 456
Dec. 57° 32′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 8	E	N	12 10 58·61
12	E	N	58·43
May 17	E	S	58·55
Mean			58·530
Δ_1			·002
Δ_2			·005
Mean R.A.			12 10 58·537

B.J. 458
Dec. 41° 10′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar. 26	W	S	12 11 37·12
Apr. 25	W	S	37·12
27	W	S	37·14
May 3	W	N	37·08
5	W	S	37·12
7	W	S	37·10
10	W	N	37·09
11	W	S	37·12
12	W	N	37·04
15	W	S	37·11
16	E	N	37·08
21	E	N	37·10
Mean			37·102
Δ_1			·002
Δ_2			–·001
Mean R.A.			12 11 37·103

12 Comae
Dec. 26° 21′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 5	W	S	12 17 58·98
7	W	S	58·97
12	W	N	59·03
15	W	S	58·93
16	E	N	58·98
Mean			58·978
Δ_1			·000
Δ_2			·000
Mean R.A.			12 17 58·978

B.J. 461
Dec. 39° 31′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar. 26	W	S	12 21 25·04
Apr. 8	E	N	25·06
12	E	N	25·04
27	W	S	25·08
May 3	W	N	25·06
5	W	S	25·02
7	W	S	25·01
10	W	N	25·05
11	W	S	25·08
12	W	N	25·08
15	W	S	25·05
16	E	N	24·98
17	E	S	25·00
21	E	N	25·04
28	W	N	25·06
Mean			25·043
Δ_1			–·004
Δ_2			–·001
Mean R.A.			12 21 25·038

15 Comae
Dec. 28° 46′

Date	Clamp	Observer	Mean R.A. 1910·0
May 3	W	N	12 22 27·22
5	W	S	27·28
10	W	N	27·28
11	W	S	27·28
12	W	N	27·32
15	W	S	27·23
16	E	N	27·28
21	E	N	27·27
28	W	N	27·29
Mean			27·272
Δ_2			–·001
Mean R.A.			12 22 27·271

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 466
Dec. 21° 24′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 5	W	S	12 25 12·02
7	W	S	12·06
11	W	S	12·04
12	W	N	12·13
15	W	S	12·01
16	E	N	11·99
Mean			12·042
Δ_1			·002
Δ_2			·001
Mean R.A.			12 25 12·045

B.J. 467
Dec. 58° 54′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar. 26	W	S	12 25 45·45
Apr. 2	W	S	45·39
8	E	N	45·39
12	E	N	45·37
27	W	S	45·43
May 17	E	S	45·37
21	E	N	45·36
28	W	N	45·34
Mean			45·388
Δ_1			—·004
Δ_2			·000
Mean R. A.			12 25 45·384

B.J. 470
Dec. 41° 51′

Date	Clamp	Observer	Mean R.A. 1910·0
Mar. 26	W	S	12 29 28·19
Apr. 2	W	S	28·25
8	E	N	28·21
12	E	N	28·28
27	W	S	28·25
May 3	W	N	28·27
5	W	S	28·25
7	W	S	28·24
10	W	N	28·30
11	W	S	28·25
12	W	N	28·19
15	W	S	28·28
16	E	N	28·23

B. J. 470
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 17	E	S	12 29 28·26
21	E	N	28·25
28	W	N	28·27
Mean			28·248
Δ_1			·003
Δ_2			—·001
Mean R.A.			12 29 28·250

23 Comae
Dec. 23° 07′

Date	Clamp	Observer	Mean R.A. 1910·0
May 3	W	N	12 30 22·09
5	W	S	22·03
10	W	N	22·14
11	W	S	22·05
12	W	N	22·06
16	E	N	22·05
21	E	N	22·10
28	W	N	22·11
Mean			22·079
Δ_1			·000
Δ_2			—·001
Mean R.A.			12 30 22·078

9 Canum Venaticorum
Dec. 41° 22′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 12	E	N	12 34 26·49
27	W	S	26·47
May 3	W	N	26·53
5	W	S	26·51
7	W	S	26·58
10	W	N	26·54
11	W	S	26·52
15	W	S	26·51
16	E	N	26·59
17	E	S	26·55
21	E	N	26·59
28	W	N	26·56
Mean			26·537
Δ_2			—·001
Mean R.A.			12 34 26·536

31 Comae
Dec. 28° 02′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Apr. 30	W	S	12 47 18·95
May 5	W	S	19·03
7	W	S	18·91
11	W	S	18·91
15	W	S	19·08
19	E	S	18·92
Mean			18·967
Δ_1			—·002
Δ_2			·002
Mean R.A.			12 47 18·967

B. J. 483
Dec. 56° 27′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 2	W	S	12 50 04·32
May 5	W	S	04·24
7	W	S	04·19
15	W	S	04·30
19	E	S	04·30
21	E	N	04·36
26	W	N	04·37
Mean			04·297
Δ_1			·002
Δ_2			—·001
Mean R.A.			12 50 04·298

B. J. 485
Dec. 38° 48′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 8	E	N	12 51 49·20
12	E	N	49·20
27	W	S	49·22
30	W	S	49·22
May 5	W	S	49·19
6	W	N	49·23
7	W	S	49·15
10	W	N	49·12
11	W	S	49·24
12	W	N	49·22
15	W	S	49·20
16	E	N	49·26
17	E	S	49·21
19	E	S	49·22

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B. J. 485 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 21	E	N	12 51 49·18
26	W	N	49·17
28	W	N	49·25
June 3	W	S	49·21
Mean			49·205
Δ_1			·000
Δ_2			−·001
Mean R.A.			12 51 49·204

14 Canum Venaticorum, Dec. 36° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 12	E	N	13 01 32·07
27	W	S	32·06
30	W	S	32·00
May 5	W	S	32·04
6	W	N	32·03
7	W	S	32·00
10	W	N	32·05
11	W	S	32·04
12	W	N	31·99
15	W	S	32·08
16	E	N	32·06
17	E	S	32·06
19	E	S	32·03
21	E	N	32·03
26	W	N	32·02
28	W	N	32·01
June 3	W	S	32·07
8	W	N	32·07
Mean			32·039
Δ_2			·000
Mean R.A.			13 01 32·039

15 Canum Venaticorum, Dec. 39° 01′

Date	Clamp	Observer	Mean R.A. 1910·0
May 11	W	S	13 05 33·61
15	W	S	33·60
19	E	S	33·61
21	E	N	33·59
26	W	N	33·57
28	W	N	33·56
June 3	W	S	33·55
8	W	N	33·64
Mean			33·591
Δ_2			−·001
Mean R.A.			13 05 33·590

B. J. 491, Dec. 38° 59′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Apr. 12	E	N	13 05 55·37
27	W	S	55·35
May 5	W	S	55·31
6	W	N	55·37
7	W	S	55·35
10	W	N	55·35
11	W	S	55·34
12	W	N	55·32
15	W	S	55·41
16	E	N	55·34
19	E	S	55·32
21	E	N	55·37
26	W	N	55·34
28	W	N	55·37
June 3	W	S	55·37
8	W	N	55·34
Mean			55·351
Δ_1			−·003
Δ_2			−·001
Mean R.A.			13 05 55·347

B. J. 492, Dec. 28° 20′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 30	W	S	13 07 40·46
May 5	W	S	40·48
6	W	N	40·38
7	W	S	40·45
10	W	N	40·51
11	W	S	40·46
12	W	N	40·52
15	W	S	40·43
16	E	N	40·51
19	E	S	40·44
21	E	N	40·44
28	W	N	40·46
June 3	W	S	40·46
8	W	N	40·49
Mean			40·464
Δ_1			−·001
Δ_2			·000
Mean R.A.			13 07 40·463

19 Canum Venaticorum, Dec. 41° 20′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Apr. 8	E	N	13 11 29·17
12	E	N	29·24
27	W	S	29·26
30	W	S	29·27
May 5	W	S	29·27
6	W	N	29·23
7	W	S	29·20
10	W	N	29·30
11	W	S	29·29
12	W	N	29·23
15	W	S	29·30
16	E	N	29·29
19	E	S	29·25
21	E	N	29·23
28	W	N	29·25
June 3	W	S	29·24
8	W	N	29·26
Mean			29·252
Δ_2			−·001
Mean R.A.			13 11 29·251

B. J. 494, Dec. 41° 03′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 8	E	N	13 13 30·54
12	E	N	30·50
27	W	S	30·48
30	W	S	30·49
May 5	W	S	30·53
6	W	N	30·48
7	W	S	30·55
10	W	N	30·48
11	W	S	30·48
12	W	N	30·66
15	W	S	30·54
16	E	N	30·46
17	E	S	30·56
19	E	S	30·50
21	E	N	30·51
26	W	N	30·51
28	W	N	30·48
June 3	W	S	30·50
8	W	N	30·50
Mean			30·513
Δ_1			−·005
Δ_2			−·001
Mean R.A.			13 13 30·507

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

23 Canum Venaticorum
Dec. 40° 37′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Apr. 8	E	N	13 16 17·01
12	E	N	17·05
27	W	S	17·06
30	W	S	17·07
May 5	W	S	17·01
7	W	S	17·06
10	W	N	17·05
11	W	S	17·10
12	W	N	17·11
15	W	S	17·08
16	E	N	17·08
17	E	S	17·05
19	E	S	17·05
21	E	N	17·09
26	W	N	17·09
June 3	W	S	17·03
4	W	S	16·99
8	W	N	17·06
9	W	S	17·07

Mean 17·060
Δ_2 ·000

Mean R.A. 13 16 17·060

B. J. 497
Dec. 55° 24′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 8	E	N	13 20 18·23
12	E	N	18·20
27	W	S	18·17
30	W	S	18·21
May 5	W	S	18·18
6	W	N	18·27
7	W	S	18·17
10	W	N	18·25
11	W	S	18·18
12	W	N	18·26
15	W	S	18·14
16	E	N	18·15
17	E	S	18·23
19	E	S	18·19
21	E	N	18·17
28	W	N	18·17
June 3	W	S	18·15
4	W	S	18·17
8	W	N	18·23
9	W	S	18·20
13	E	N	18·30

B. J. 497
(continued)

h m s
Mean 13 20 18·201
Δ_1 ·003
Δ_2 −·002

Mean R.A. 13 20 18·202

81 Ursae Majoris
Dec. 55° 49′

Date	Clamp	Observer	Mean R.A. 1910·0
May 5	W	S	13 30 39·69
17	E	S	39·70

Mean 39·695
Δ_2 ·003

Mean R.A. 13 30 39·698

B. J. 502
Dec. 37° 39′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 30	W	S	13 30 46·77
May 6	W	N	46·74
7	W	S	46·71
11	W	S	46·76
12	W	N	46·75
15	W	S	46·75
16	E	N	46·80
19	E	S	46·84
21	E	N	46·79
28	W	N	46·74
June 3	W	S	46·76
4	W	S	46·77
8	W	N	46·81
9	W	S	46·79
13	E	N	46·82
15	E	S	46·80
19	W	S	46·77

Mean 46·775
Δ_1 ·003
Δ_2 ·000

Mean R.A. 13 30 46·778

25 Canum Venaticorum
Dec. 36° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Apr. 8	E	N	13 33 27·78
12	E	N	27·90
30	W	S	27·85
May 5	W	S	27·74
6	W	N	27·81
7	W	S	27·79
10	W	N	27·81
11	W	S	27·78
12	W	N	27·77
15	W	S	27·78
16	E	N	27·81
17	E	S	27·80
19	E	S	27·79
21	E	N	27·79
28	W	N	27·80
June 3	W	S	27·75
4	W	S	27·78
8	W	N	27·81
9	W	S	27·81
18	W	N	27·82
19	W	S	27·77

Mean 27·797
Δ_1 ·000
Δ_2 ·000

Mean R.A. 13 33 27·797

B.J. 507
Dec. 17° 54′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 30	W	S	13 42 59·15
May 5	W	S	59·09
6	W	N	59·12
7	W	S	59·18
10	W	N	59·18
11	W	S	59·08
12	W	N	59·04
15	W	S	59·12
16	E	N	59·15
19	E	S	59·13
21	E	N	59·09
26	W	N	59·11
28	W	N	59·09
June 3	W	S	59·14
4	W	S	59·15
8	W	N	59·10
9	W	S	59·12

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B. J. 507 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 13	E	N	13 42 59·04
15	E	S	59·11
18	W	N	59·11
19	W	S	59·08

Mean 59·113
Δ_1 −·001
Δ_2 ·001
Mean R.A. 13 42 59·113

B.J. 509
Dec. 49° 46′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 8	E	N	13 43 59·74
30	W	S	59·68
May 5	W	S	59·69
6	W	N	59·65
7	W	S	59·69
10	W	N	59·77
11	W	S	59·61
12	W	N	59·72
15	W	S	59·65
16	E	N	59·70
17	E	S	59·75
19	E	S	59·63
21	E	N	59·73
26	W	N	59·71
28	W	N	59·69
June 3	W	S	59·70
4	W	S	59·68
8	W	N	59·79
9	W	S	59·63
13	E	N	59·77
15	E	S	59·76
18	W	N	59·75
19	W	S	59·71

Mean 59·704
Δ_1 −·003
Δ_2 −·001
Mean R.A. 13 43 59·700

B.J. 513
Dec. 18° 51′

Date	Clamp	Observer	Mean R.A. 1910·0
May 5	W	S	13 50 24·00
6	W	N	23·99
7	W	S	24·03
11	W	S	24·00

B.J. 513 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 12	W	N	13 50 23·96
15	W	S	24·01
16	E	N	24·00
19	E	S	24·00
21	E	N	23·97
26	W	N	23·91
June 3	W	S	23·96
4	W	S	23·98
8	W	N	23·97
9	W	S	24·01
13	E	N	23·98
15	E	S	23·99
18	W	N	23·95
19	W	S	23·96

Mean 23·982
Δ_1 −·004
Δ_2 ·001
Mean R.A. 13 50 23·979

B.J. 517
Dec. 27° 49′

Date	Clamp	Observer	Mean R.A. 1910·0
May 7	W	S	13 57 05·66
11	W	S	05·62
12	W	N	05·66
15	W	S	05·59
16	E	N	05·71
19	E	S	05·63
21	E	N	05·60
26	W	N	05·68
June 3	W	S	05·59
4	W	S	05·67
8	W	N	05·61
9	W	S	05·66
13	E	N	05·65
18	W	N	05·64
19	W	S	05·63

Mean 05·640
Δ_1 ·004
Δ_2 ·000
Mean R.A. 13 57 05·644

9 H. Boötis
Dec. 44° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
May 5	W	S	14 04 19·92
7	W	S	20·00
11	W	S	19·84
15	W	S	19·94

9 H. Boötis (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 16	E	N	14 04 19·92
19	E	S	19·99
21	E	N	19·91
26	W	N	19·93
28	W	N	19·94
June 3	W	S	19·93
4	W	S	19·86
8	W	N	19·97
9	W	S	19·91
13	E	S	19·89
18	W	S	19·88
19	W	N	19·91

Mean 19·921
Δ_2 −·001
Mean R.A. 14 04 19·920

B.J. 522
Dec. 25° 31′

Date	Clamp	Observer	Mean R.A. 1910·0
May 5	W	S	14 06 17·69
7	W	S	17·70
11	W	S	17·69
15	W	S	17·68
16	E	N	17·72
19	E	S	17·69
21	E	N	17·69
26	W	N	17·67
28	W	N	17·68
June 3	W	S	17·65
4	W	S	17·64
8	W	N	17·65
9	W	S	17·68
13	E	N	17·67
18	W	N	17·69
19	W	S	17·67

Mean 17·679
Δ_1 ·004
Δ_2 ·000
Mean R.A. 14 06 17·683

B.J. 526
Dec. 19° 39′

Date	Clamp	Observer	Mean R.A. 1910·0
May 5	W	S	14 11 33·44
6	W	N	33·40
7	W	S	33·42
11	W	S	33·41

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 526 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 15	W	S	14 11 33·44
16	E	N	33·39
19	E	S	33·45
21	E	N	33·39
26	W	N	33·28
28	W	N	33·41
June 3	W	S	33·40
4	W	S	33·45
8	W	N	33·40
9	W	S	33·44
13	E	N	33·36
15	E	S	33·40
18	W	N	33·34
19	W	S	33·34
Mean			33·398
Δ_1			—·003
Δ_2			·001
Mean R.A.			14 11 33·396

B.J. 527
Dec. 46° 30′

Date	Clamp	Observer	Mean R.A. 1910·0
Apr. 8	E	N	14 12 57·77
May 5	W	S	57·70
6	W	N	57·81
7	W	S	57·76
15	W	S	57·69
16	E	N	57·74
17	E	S	57·79
19	E	S	57·71
21	E	N	57·83
26	W	N	57·70
28	W	N	57·77
June 3	W	S	57·74
4	W	S	57·76
8	W	N	57·75
9	W	S	57·78
10	E	N	57·80
Mean			57·756
Δ_1			·003
Δ_2			—·001
Mean R.A.			14 12 57·758

B.J. 528
Dec. 51° 47′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 13	E	S	14 12 58·76
18	W	S	58·73
19	W	N	58·77
Mean			58·753
Δ_1			—·003
Δ_2			·000
Mean R.A.			14 12 58·750

B.J. 531
Dec. 52° 16′

Date	Clamp	Observer	Mean R.A. 1910·0
May 17	E	S	14 22 07·95
28	W	N	07·88
June 3	W	S	07·95
4	W	S	07·93
8	W	N	07·97
9	W	S	07·92
13	E	N	08·05
15	E	S	08·03
18	W	N	08·04
19	W	S	07·99
25	W	S	08·06
Mean			07·979
Δ_1			·003
Δ_2			—·001
Mean R.A.			14 22 07·981

***f* Boötis**
Dec. 19° 38′

Date	Clamp	Observer	Mean R.A. 1910·0
May 5	W	S	14 22 16·13
6	W	N	16·17
7	W	S	16·24
11	W	S	16·16
15	W	S	16·15
16	E	N	16·19
19	E	S	16·18
21	E	N	16·20
June 10	E	N	16·15
Mean			16·174
Δ_1			·002
Δ_2			·000
Mean R.A.			14 22 16·176

***g* Boötis**
Dec. 50° 15′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 17	E	S	14 25 29·95
June 9	W	S	29·95
13	E	S	29·93
15	W	S	29·98
19	W	N	30·05
28	E	S	29·96
Mean			29·970
Δ_2			·002
Mean R.A.			14 25 29·972

204 B.Boötis
Dec. 42° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
May 5	W	S	14 26 03·98
6	W	N	04·03
7	W	S	03·98
11	W	S	03·97
15	W	S	03·97
16	E	N	03·93
19	E	S	03·99
21	E	N	03·99
26	W	N	03·96
28	W	N	03·96
June 3	W	S	03·97
4	W	S	03·99
8	W	N	04·08
10	E	N	03·95
Mean			03·982
Δ_2			—·001
Mean R.A.			14 26 03·981

5 Ursae Minoris
Dec. 76° 06′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	14 27 42·26
28	E	S	42·17
Mean			42·215
Δ_1			·000
Δ_2			·007
Mean R.A.			14 27 42·222

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 534
Dec. 30° 46′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 5	W	S	14 27 57·13
6	W	N	57·07
7	W	S	57·11
11	W	S	57·06
15	W	S	57·04
16	E	N	57·01
19	E	S	57·07
21	E	N	57·11
26	W	N	57·05
28	W	N	57·08
June 3	W	S	57·05
4	W	S	57·11
8	W	N	57·11
9	W	S	57·06
10	E	N	57·09
13	E	N	57·07
15	E	S	57·08
18	W	N	57·09
19	W	S	57·09

Mean 57·078
Δ_1 ·002
Δ_2 ·000

Mean R.A. 14 27 57·080

B.J. 535
Dec. 38° 42′

Date	Clamp	Observer	Mean R.A. 1910·0
May 17	E	S	14 28 27·24
26	W	N	27·30
28	W	N	27·25
June 8	W	N	27·30
10	E	N	27·26
13	E	N	27·27
15	E	S	27·24
18	W	N	27·35
19	W	S	27·25

Mean 27·273
Δ_1 —·003
Δ_2 —·001

Mean R.A. 14 28 27·269

σ Boötis
Dec. 30° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 6	W	N	14 30 45·71
11	W	S	45·69
15	W	S	45·70
16	E	N	45·76
17	E	S	45 70
19	E	S	45·70
21	E	N	45·72
26	W	N	45·74
27	W	S	45·73
28	W	N	45·72
June 3	W	S	45·72
4	W	S	45·72
8	W	N	45·65
9	W	S	45·68
10	E	N	45·69
13	E	S	45·73
18	W	S	45·69
19	W	N	45·69
25	W	S	45·68
28	E	S	45·72

Mean 45·707
Δ_1 ·004
Δ_2 ·000

Mean R.A. 14 30 45·711

B.J. 540
Dec. 44° 48′

Date	Clamp	Observer	Mean R.A. 1910·0
May 6	W	N	14 35 29·28
11	W	S	29·28
15	W	S	29·25
16	E	N	29·27
19	E	S	29·17
21	E	N	29·30
26	W	N	29·21
27	W	S	29·28
28	W	N	29·27
June 3	W	S	29·29
4	W	S	29·25
8	W	N	29·34
9	W	S	29·25
10	E	N	29·26
13	E	N	29·21
15	E	S	29·25
18	W	N	29·32
19	W	S	29·25

B.J. 540
(continued)

h m s
Mean 14 35 29·263
Δ_1 —·002
Δ_2 —·001

Mean R.A. 14 35 29·260

B.D. 80·448
Dec. 80° 03′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	14 36 05·55
28	E	S	05·55

Mean 05·550
Δ_2 ·009

Mean R.A. 14 36 05·559

B.J. 543
Dec. 14° 07′

Date	Clamp	Observer	Mean R.A. 1910·0
May 11	W	S	14 36 51·07
15	W	S	51·05
16	E	N	51·04
19	E	S	51·04
21	E	N	51·07
26	W	N	51·05
27	W	S	51·06
28	W	N	51·07
June 3	W	S	51·03
4	W	S	51·08
8	W	N	51·00
9	W	S	50·98
10	E	N	51·07
13	E	N	51·06
15	E	S	51·04
18	W	N	51·03
19	W	S	51·02

Mean 51·045
Δ_1 ·000
Δ_2 ·000

Mean R.A. 14 36 51·045

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

34 Boötis
Dec. 26° 55′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 11	W	S	14 39 28·08
15	W	S	28·02
16	E	N	28·03
19	E	S	28·06
21	E	N	28·05
26	W	N	28·05
27	W	S	28·03
28	W	N	28·12
June 3	W	S	27·99
4	W	S	28·09
8	W	N	28·10
9	W	S	28·03
10	E	N	28·04
13	E	N	28·00
15	E	S	28·03
18	W	N	28·08
19	W	S	28·01
Mean			28·048
Δ_2			·000
Mean R.A.			14 39 28·048

ε Boötis
Dec. 27° 27′

Date	Clamp	Observer	Mean R.A. 1910·0
May 11	W	S	14 41 03·42
15	W	S	03·41
16	E	N	03·43
19	E	S	03·43
21	E	N	03·45
26	W	N	03·33
27	W	S	03·41
28	W	N	03·43
June 3	W	S	03·41
4	W	S	03·41
8	W	N	03·41
9	W	S	03·37
10	E	N	03·45
13	E	N	03·45
15	E	S	03·38
18	W	N	03·38
19	W	S	03·43
Mean			03·412
Δ_1			·003
Δ_2			·000
Mean R.A.			14 41 03·415

295 B.Boötis
Dec. 38° 11′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 11	W	S	14 45 34·66
15	W	S	34·68
16	E	N	34·75
19	E	S	34·70
21	E	N	34·73
26	W	N	34·68
27	W	S	34·69
28	W	N	34·72
June 3	W	S	34·71
4	W	S	34·63
8	W	N	34·73
9	W	S	34·74
10	E	N	34·69
13	E	S	34·72
18	W	S	34·72
19	W	N	34·58
25	W	S	34·70
28	E	S	34·67
Mean			34·694
Δ_2			·000
Mean R.A.			14 45 34·694

ξ Boötis
Dec. 19° 28′

Date	Clamp	Observer	Mean R.A. 1910·0
May 11	W	S	14 47 14·14
15	W	S	14·03
16	E	N	14·10
19	E	S	14·10
21	E	N	14·19
26	W	N	14·16
27	W	S	14·08
28	W	N	14·12
June 3	W	S	14·13
4	W	S	14·06
8	W	N	14·17
9	W	S	14·09
10	E	N	14·09
13	E	N	14·11
15	E	S	14·09
18	W	N	14·08
19	W	S	14·12
Mean			14·109
Δ_2			·000
Mean R.A.			14 47 14·109

B.J. 549
Dec. 59° 40′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 16	E	N	14 49 09·09
21	E	N	09·18
26	W	N	09·23
27	W	S	09·20
28	W	N	09·24
June 3	W	S	09·22
4	W	S	09·24
8	W	N	09·26
9	W	S	09·26
10	E	N	09·22
13	E	N	09·30
15	E	S	09·23
18	W	N	09·27
19	W	S	09·26
28	E	S	09·24
29	E	S	09·23
Mean			09·229
Δ_1			−·001
Δ_2			−·001
Mean R.A.			14 49 09·227

B.J. 550
Dec. 74° 31′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	14 50 57·35
28	E	S	57·37
29	E	S	57·37
Mean			57·363
Δ_1			−·003
Δ_2			·011
Mean R.A.			14 50 57·371

B.J. 551
Dec. 14° 49′

Date	Clamp	Observer	Mean R.A. 1910·0
May 15	W	S	14 51 58·28
19	E	S	58·32
27	W	S	58·31
28	W	N	58·30
June 3	W	S	58·33
8	W	N	58·32
9	W	S	58·30
10	E	N	58·29
13	E	N	58·28

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 551 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 15	E	S	14 51 58·27
18	W	N	58·26
19	W	S	58·32
July 5	E	S	58·32
Mean			58·300
Δ_1			—·005
Δ_2			·001
Mean R.A.			14 51 58·296

Groombridge 2184 Dec. 78° 32′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	14 55 09·59
28	E	S	09·58
29	E	S	09·44
Mean			09·537
Δ_2			·016
Mean R.A.			14 55 09·553

B.J. 555 Dec. 40° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
May 15	W	S	14 58 33·33
19	E	S	33·32
26	W	N	33·30
27	W	S	33·31
28	W	N	33·29
June 3	W	S	33·31
4	W	S	33·35
8	W	N	33·28
9	W	S	33·33
10	E	N	33·39
13	E	S	33·37
18	W	S	33·35
19	W	N	33·31
28	E	S	33·33
29	E	S	33·33
July 5	E	S	33·37
6	E	N	33·38
Mean			33·332
Δ_1			·003
Δ_2			·000
Mean R.A.			14 58 33·335

B.J. 557 Dec. 27° 18′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 15	W	S	15 00 35·34
19	E	S	35·34
28	W	N	35·39
June 3	W	S	35·34
4	W	S	35·40
8	W	N	35·34
10	E	N	35·35
13	E	N	35·36
15	E	S	35·36
18	W	N	35·32
19	W	S	35·35
July 5	E	S	35·35
6	E	N	35·37
Mean			35·355
Δ_1			·001
Δ_2			·000
Mean R.A.			15 00 35·356

i Boötis Dec. 48° 00′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	15 00 49·42
June 9	W	S	49·46
Mean			49·440
Δ_2			—·001
Mean R.A.			15 00 49·439

c Boötis Dec. 25° 13′

Date	Clamp	Observer	Mean R.A. 1910·0
May 11	W	S	15 03 20·89
15	W	S	20·85
19	E	S	20·88
27	W	S	20·86
June 3	W	S	20·84
4	W	S	20·95
8	W	N	20·83
9	W	S	20·82
10	E	N	20·84
Mean			20·862
Δ_1			·003
Δ_2			·001
Mean R.A.			15 03 20·866

B.J. 563 Dec. 33° 39′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 15	W	S	15 11 52·44
27	W	S	52·43
28	W	N	52·43
June 3	W	S	52·45
4	W	S	52·56
8	W	N	52·39
9	W	S	52·45
10	E	N	52·46
13	E	N	52·43
15	E	S	52·45
18	W	N	52·52
19	W	S	52·45
25	W	S	52·52
28	E	S	52·46
29	E	S	52·46
July 5	E	S	52·45
6	E	N	52·44
13	E	N	52·50
Mean			52·461
Δ_1			·000
Δ_2			·000
Mean R.A.			15 11 52·461

11 Ursae Minoris Dec. 72° 09′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	15 17 09·60
28	E	S	09·65
29	E	S	09·41
July 11	E	N	09·83
13	E	N	09·72
Mean			09·642
Δ_2			·009
Mean R.A.			15 17 09·651

η Coronae Borealis Dec. 30° 37′

Date	Clamp	Observer	Mean R.A. 1910·0
May 11	W	S	15 19 29·22
15	W	S	29·17
27	W	S	29·16
28	W	N	29·11

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

η Coronae Borealis (continued)

Date	Clamp	Observer	Mean R.A. 1910·0 (h m s)
June 3	W	S	15 19 29·16
4	W	S	29·10
8	W	N	29·14
9	W	S	29·17
13	E	N	29·17
15	E	S	29·15
18	W	N	29·22
19	W	S	29·17
29	E	S	29·15
July 5	E	S	29·17
11	E	N	29·25
13	E	N	29·18

Mean 29·168
Δ_1 ·000
Δ_2 ·000

Mean R.A. 15 19 29·168

B.J. 569
Dec. 72° 09′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	15 20 51·78
28	E	S	51·68
29	E	S	51·66
July 13	E	N	51·88

Mean 51·750
Δ_1 ·001
Δ_2 ·010

Mean R.A. 15 20 51·761

B.J. 568
Dec. 37° 42′

Date	Clamp	Observer	Mean R.A. 1910·0
May 11	W	S	15 21 05·44
15	W	S	05·39
27	W	S	05·37
28	W	N	05·43
June 3	W	S	05·46
4	W	S	05·26
8	W	N	05·39
9	W	S	05·40
10	E	N	05·38
13	E	S	05·41

B.J. 568 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0 (h m s)
June 18	W	S	15 21 05·39
19	W	N	05·44
July 5	E	S	05·40
6	E	N	05·43

Mean 05·399
Δ_1 ·000
Δ_2 ·000

Mean R.A. 15 21 05·399

B.J. 571
Dec. 59° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	15 22 55·42
28	W	N	55·41
June 3	W	S	55·49
4	W	S	55·56
8	W	N	55·47
9	W	S	55·48
10	E	N	55·50
13	E	S	55·49
18	W	S	55·58
19	W	N	55·66
25	W	S	55·50
28	E	S	55·48
29	E	S	55·49
July 5	E	S	55·47
6	E	N	55·50
11	E	N	55·53
13	E	N	55·54

Mean 55·504
Δ_1 −·002
Δ_2 ·000

Mean R.A. 15 22 55·502

B.J. 572
Dec. 29° 25′

Date	Clamp	Observer	Mean R.A. 1910·0
May 11	W	S	15 24 07·10
15	W	S	07·06
27	W	S	07·11
June 3	W	S	07·06

B.J. 572 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0 (h m s)
June 4	W	S	15 24 07·11
9	W	S	07·04
10	E	N	07·06
13	E	N	07·09
15	E	S	07·06
18	W	N	07·07
19	W	S	07·08
July 5	E	S	07·08
6	E	N	07·14

Mean 07·082
Δ_1 ·003
Δ_2 ·001

Mean R.A. 15 24 07·086

B.J. 573
Dec. 41° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
May 11	W	S	15 27 41·76
15	W	S	41·77
27	W	S	41·74
28	W	N	41·78
June 3	W	S	41·79
4	W	S	41·74
8	W	N	41·70
9	W	S	41·75
10	E	N	41·77
13	E	N	41·83
15	E	S	41·70
18	W	N	41·79
19	W	S	41·73
25	W	S	41·75r
28	E	S	41·71
29	E	S	41·76
July 5	E	S	41·78r
6	E	N	41·78
11	E	N	41·80r
13	E	N	41·75

Mean 41·759
Δ_1 −·003
Δ_2 ·000

Mean R.A. 15 27 41·756

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

ν^2 Boötis — Dec. 41° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 11	W	S	15 28 33·67
15	W	S	33·60
27	W	S	33·55
28	W	N	33·68
June 3	W	S	33·64
4	W	S	33·60
8	W	N	33·69
9	W	S	33·62
10	E	N	33·73
13	E	N	33·63
15	E	S	33·60
18	W	N	33·67
19	W	S	33·62
25	W	S	33·65
29	E	S	33·63 r
July 5	E	S	33·60
6	E	N	33·63 r
11	E	N	33·67
13	E	N	33·64 r
Mean			33·638
Δ_2			·000
Mean R.A.			15 28 33·638

B.J. 576 — Dec. 31° 40′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	15 29 17·96
28	W	N	18·04
June 3	W	S	17·97
10	E	N	18·05
13	E	S	17·96
18	W	S	18·01
19	W	N	18·01
25	W	S	18·00
28	E	S	17·99
29	E	S	18·01
July 13	E	N	18·06
Mean			18·005
Δ_1			—·005
Δ_2			·000
Mean R.A.			15 29 18·000

B.J. 578 — Dec. 27° 01′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 15	W	S	15 30 52·69
19	E	S	52·80
27	W	S	52·67
28	W	N	52·61
June 3	W	S	52·67
4	W	S	52·58
8	W	N	52·58
9	W	S	52·62
10	E	N	52·58
13	E	N	52·65
15	E	S	52·65
18	W	N	52·63
19	W	S	52·65
July 5	E	S	52·64
6	E	N	52·65
13	E	N	52·64
Mean			52·644
Δ_1			—·001
Δ_2			·000
Mean R.A.			15 30 52·643

θ Ursae Minoris — Dec. 77° 39′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	15 34 03·88
28	E	S	03·88
29	E	S	03·98
July 11	E	N	03·96
13	E	N	04·09
Mean			03·958
Δ_2			·014
Mean R.A.			15 34 03·972

B.J. 580 — Dec. 40° 39′

Date	Clamp	Observer	Mean R.A. 1910·0
May 15	W	S	15 34 35·60
19	E	S	35·59
27	W	S	35·65
28	W	N	35·62

B.J. 580 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 3	W	S	15 34 35·59
4	W	S	35·64
8	W	N	35·65
9	W	S	35·69
10	E	N	35·68
13	E	S	35·63
18	W	S	35·62
19	W	N	35·56
July 5	E	S	35·63
6	E	N	35·62
Mean			35·626
Δ_1			·002
Δ_2			·000
Mean R.A.			15 34 35·628

ζ Coronae Borealis — Dec. 36° 56′

Date	Clamp	Observer	Mean R.A. 1910·0
May 15	W	S	15 35 59·28
19	E	S	59·23
27	W	S	59·29
28	W	N	59·30
June 3	W	S	59·27
4	W	S	59·30
8	W	N	59·33
9	W	S	59·32
10	E	N	59·29
13	E	N	59·29
15	E	S	59·25
18	W	N	59·35
19	W	S	59·24
July 5	E	S	59·22
6	E	N	59·26
13	E	N	59·35
Mean			59·286
Δ_1			—·005
Δ_2			·000
Mean R.A.			15 35 59·281

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

ι Serpentis
Dec. 19° 58′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 15	W	S	15 37 32·27
19	E	S	32·28
27	W	S	32·22
28	W	N	32·31
June 3	W	S	32·26
4	W	S	32·31
8	W	N	32·28
9	W	S	32·25
10	E	N	32·25
13	E	N	32·32
15	E	S	32·26
18	W	N	32·30
19	W	S	32·25
July 5	E	S	32·28
6	E	N	32·28
11	E	N	32·25
13	E	N	32·25

Mean 32·272
Δ_2 ·000

Mean R.A. 15 37 32·272

B.J. 581
Dec. 26° 35′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	15 38 57·75
27	W	S	57·66
28	W	N	57·76
June 3	W	S	57·80
4	W	S	57·77
8	W	N	57·82
9	W	S	57·77
10	E	N	57·77
13	E	N	57·74
15	E	S	57·78
18	W	N	57·75
19	W	S	57·79
July 4	E	S	57·80
6	E	N	57·79
11	E	N	57·79
13	E	N	57·69

Mean 57·764
Δ_1 —·005
Δ_2 ·000

Mean R.A. 15 38 57·759

B.J. 583
Dec. 15° 42′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 19	E	S	15 42 02·01
26	W	N	01·99
27	W	S	01·93
28	W	N	01·94
June 3	W	S	02·00
4	W	S	01·98
8	W	N	02·07
9	W	S	02·01
10	E	N	01·91
13	E	N	01·97
15	E	S	01·99
18	W	N	02·00
19	W	S	01·99
July 5	E	S	02·01
6	E	N	01·97
11	E	N	02·01r
13	E	N	01·98

Mean 01·986
Δ_1 ·002
Δ_2 ·000

Mean R.A. 15 42 01·988

B.J. 584
Dec. 18° 25′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	15 44 41·30
26	W	N	41·33
27	W	S	41·33
28	W	N	41·28
June 3	W	S	41·26
4	W	S	41·25
8	W	N	41·25
9	W	S	41·30
10	E	N	41·27
13	E	N	41·26
15	E	S	41·22
18	W	N	41·26
19	W	S	41·29
July 5	E	S	41·26r
6	E	N	41·23r
11	E	N	41·26
13	E	N	41·21r

Mean 41·268
Δ_1 —·002
Δ_2 ·000

Mean R.A. 15 44 41·266

B.J. 590
Dec. 78° 04′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 25	W	S	15 47 14·82
28	E	S	14·91
29	E	S	14·98
July 11	E	N	14·91
13	E	N	15·28

Mean 14·980
Δ_1 ·000
Δ_2 ·015

Mean R.A. 15 47 14·995

χ Herculis
Dec. 42° 42′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	15 49 33·78
26	W	N	33·76
27	W	S	33·83
28	W	N	33·83
June 3	W	S	33·73
4	W	S	33·72
8	W	N	33·80
9	W	S	33·78
10	E	N	33·73
13	E	S	33·78
18	W	S	33·76
19	W	N	33·74
25	W	S	33·76r
28	E	S	33·75
29	E	S	33·77r
July 4	E	S	33·74
5	E	S	33·78
6	E	N	33·76
11	E	N	33·73
13	E	N	33·77

Mean 33·765
Δ_1 ·000
Δ_2 ·000

Mean R.A. 15 49 33·765

B.J. 591
Dec. 15° 57′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	15 52 17·63
26	W	N	17·78
27	W	S	17·70
28	W	N	17·67

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 591 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 3	W	S	15 52 17·67
4	W	S	17·60
8	W	N	17·73
9	W	S	17·69
10	E	N	17·69
13	E	N	17·73
15	E	S	17·70
18	W	N	17·74
19	W	S	17·75
July 4	E	S	17·67
5	E	S	17·72
6	E	N	17·71
11	E	N	17·73
13	E	N	17·76

Mean 17·704
Δ_1 ·000
Δ_2 ·000

Mean R.A. 15 52 17·704

B.J. 593
Dec. 27° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	15 53 51·63
26	W	N	51·71
27	W	S	51·73
28	W	N	51·70
June 3	W	S	51·69
4	W	S	51·62
8	W	N	51·67
9	W	S	51·61
10	E	N	51·67
13	E	N	51·62
15	E	S	51·62
18	W	N	51·58
19	W	S	51·68
July 4	E	S	51·65
5	E	S	51·67
6	E	N	51·59
11	E	N	51·59
13	E	N	51·68

Mean 51·651
Δ_1 −·003
Δ_2 ·000

Mean R.A. 15 53 51·648

B.J. 595
Dec. 55° 00′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 19	E	S	15 55 39·16
26	W	N	39·14
27	W	S	39·19
28	W	N	39·23
June 3	W	S	39·15
4	W	S	39·27
8	W	N	39·14
9	W	S	39·20
10	E	N	39·10
13	E	S	39·20
18	W	S	39·20
19	W	N	39·24
25	W	S	39·26
28	E	S	39·17
29	E	S	39·18
July 4	E	S	39·19
5	E	S	39·14
6	E	N	39·21
11	E	N	39·18
13	E	N	39·19

Mean 39·187
Δ_1 −·005
Δ_2 ·001

Mean R.A. 15 55 39·183

τ Herculis
Dec. 18° 04′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	15 57 11·61
26	W	N	11·63
27	W	S	11·61
28	W	N	11·65
June 3	W	S	11·66
4	W	S	11·61
8	W	N	11·70
9	W	S	11·64
10	E	N	11·69
13	E	N	11·69
15	E	S	11·60
18	W	N	11·57
19	W	S	11·67
July 4	E	S	11·62
5	E	S	11·66
6	E	N	11·59
11	E	N	11·57
13	E	N	11·73

Mean 11·639
Δ_2 ·000

Mean R.A. 15 57 11·639

B.J. 598
Dec. 58° 48′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 19	E	S	16 00 11·95
26	W	N	12·01
27	W	S	12·05
June 3	W	S	11·96
4	W	S	12·00
8	W	N	11·99
9	W	S	11·99
10	E	N	11·96
13	E	N	12·12
15	E	S	12·00
18	W	N	11·95
19	W	S	12·03
25	W	S	11·94
28	E	S	12·00
29	E	S	11·99
July 4	E	S	11·98
5	E	S	11·97
6	E	N	11·99
11	E	N	11·94
13	E	N	11·89

Mean 11·986
Δ_1 ·003
Δ_2 ·001

Mean R.A. 16 00 11·990

κ Herculis
Dec. 17° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	16 04 00·74
27	W	S	00·77
June 3	W	S	00·74
4	W	S	00·74
8	W	N	00·77
9	W	S	00·73
10	E	N	00·73
13	E	N	00·73
15	E	S	00·78
18	W	N	00·68
19	W	S	00·81
July 4	E	S	00·78
5	E	S	00·74
6	E	N	00·75
13	E	N	00·75

Mean 00·749
Δ_1 ·002
Δ_2 ·000

Mean R.A. 16 04 00·751

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

τ Coronae Borealis
Dec. 36° 43′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 19	E	S	16 05 40·82
June 3	W	S	40·76
4	W	S	40·78
8	W	N	40·75
10	E	N	40·73
13	E	N	40·78
15	E	S	40·76
18	W	N	40·77
19	W	S	40·78
July 6	E	N	40·82
13	E	N	40·84

Mean 40·781
Δ_2 ·000
Mean R.A. 16 05 40·781

B.J. 601
Dec. 45° 10′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	16 05 56·11
June 9	W	S	56·07

Mean 56·090
Δ_1 −·002
Δ_2 −·001
Mean R.A. 16 05 56·087

σ² Coronae Borealis
Dec. 34° 05′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	16 11 18·55
June 4	W	S	18·42
9	W	S	18·56
13	E	N	18·54
15	E	S	18·50
18	W	N	18·47
19	W	S	18·51
July 4	E	S	18·46
5	E	S	18·49
6	E	N	18·50
11	E	N	18·53
13	E	N	18·50

Mean 18·503
Δ_1 −·002
Δ_2 ·001
Mean R.A. 16 11 18·502

B.J. 606
Dec. 76° 06′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 25	W	S	16 13 22·36
28	E	S	22·39
29	E	S	22·50
July 11	E	N	22·57
13	E	N	22·37

Mean 22·438
Δ_1 −·004
Δ_2 ·013
Mean R.A. 16 13 22·447

20 Ursae Minoris
Dec. 75° 26′

Date	Clamp	Observer	Mean R.A. 1910·0
July 13	E	N	16 14 47·14

Δ_2 ·012
Mean R.A. 16 14 47·152

Groombridge 2337
Dec. 73° 37′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	16 16 01·61
28	E	S	01·46
29	E	S	01·47

Mean 01·513
Δ_2 ·011
Mean R.A. 16 16 01·524

B.J. 608
Dec. 46° 32′

Date	Clamp	Observer	Mean R.A. 1910·0
June 9	W	S	16 17 02·08
13	E	N	02·03
15	E	S	02·11
18	W	N	02·11
19	W	S	02·10
July 4	E	S	02·00
5	E	S	02·07
6	E	N	02·03

Mean 02·066
Δ_1 ·000
Δ_2 ·001
Mean R.A. 16 17 02·067

B.J. 609
Dec. 19° 22′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 19	E	S	16 17 56·92
June 4	W	S	56·97

Mean 56·945
Δ_1 ·004
Δ_2 ·002
Mean R.A. 16 17 56·951

ξ Coronae Borealis
Dec. 31° 06′

Date	Clamp	Observer	Mean R.A. 1910·0
June 13	E	N	16 18 35·42
15	E	S	35·43
18	W	N	35·42
19	W	S	35·41
29	E	S	35·40
July 4	E	S	35·38
5	E	S	35·35
6	E	N	35·31
11	E	N	35·37
13	E	N	35·37

Mean 35·386
Δ_2 ·001
Mean R.A. 16 18 35·387

23 Herculis
Dec. 32° 33′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	16 19 29·11
June 4	W	S	29·11
13	E	S	29·10
18	W	S	29·19
19	W	N	29·25
July 4	E	S	29·10
5	E	S	29·13
6	E	N	29·18

Mean 29·146
Δ_2 ·001
Mean R.A. 16 19 29·147

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 612
Dec. 75° 58′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 25	W	S	16 20 07·35r
29	E	S	07·33r
July 11	E	N	07·38
13	E	N	07·20r
Mean			07·315
Δ_1			—·003
Δ_2			·009
Mean R.A.			16 20 07·321

B.J. 613
Dec. 14° 14′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	16 21 15·69
June 4	W	S	15·63
13	E	N	15·64
15	E	S	15·71
19	W	S	15·73
July 4	E	S	15·66
5	E	S	15·70
6	E	N	15·71
Mean			15·684
Δ_1			—·005
Δ_2			·000
Mean R.A.			16 21 15·679

B.J. 614
Dec. 55° 25′

Date	Clamp	Observer	Mean R.A. 1910·0
May 26	W	N	16 22 27·13
June 15	E	S	27·04
19	W	S	27·10
25	W	S	27·22r
28	E	S	27·09
29	E	S	27·13r
July 4	E	S	27·07
5	E	S	27·06
6	E	N	27·16
11	E	N	27·16r
13	E	N	27·06r
19	E	S	27·17
Mean			27·116
Δ_1			—·001
Δ_2			·003
Mean R.A.			16 22 27·118

g Herculis
Dec. 42° 05′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 19	E	S	16 25 41·04
June 4	W	S	41·09
13	E	N	41·07
15	E	S	41·12
18	W	N	41·11
19	W	S	41·13
25	W	S	41·14
28	E	S	41·16r
29	E	S	41·10
July 4	E	S	41·14
5	E	S	41·11
6	E	N	41·07
11	E	N	41·11
13	E	N	41·16r
19	E	S	41·13
Mean			41·112
Δ_2			·002
Mean R.A.			16 25 41·114

B.J. 618
Dec. 21° 41′

Date	Clamp	Observer	Mean R.A. 1910·0
July 6	E	N	16 26 21·01
Δ_1			·003
Δ_2			—·002
Mean R.A.			16 26 21·011

Groombridge 2372
Dec. 79° 09′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	16 30 43·03
28	E	S	42·96r
29	E	S	42·90
July 11	E	N	43·14
13	E	N	42·92
19	E	S	43·07r
Mean			43·003
Δ_2			·019
Mean R.A.			16 30 43·022

B.J. 621
Dec. 42° 37′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 19	E	S	16 31 12·06
26	W	N	12·10
27	W	S	12·00
June 13	E	S	12·01
18	W	S	12·01
19	W	N	12·08
July 4	E	S	12·03
5	E	S	12·02
6	E	N	12·01
Mean			12·036
Δ_1			·003
Δ_2			·001
Mean R.A.			16 31 12·040

B.D. 72·734
Dec. 72° 48′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	16 32 50·56
28	E	S	50·50
29	E	S	50·53
July 11	E	N	50·67
13	E	N	50·58
19	E	S	50·61
Mean			50·575
Δ_2			·011
Mean R.A.			16 32 50·586

B.J. 623
Dec. 77° 38′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	16 34 30·06
July 11	E	N	30·04
13	E	N	29·97
19	E	S	29·97
Mean			30·010
Δ_1			—·004
Δ_2			·010
Mean R.A.			16 34 30·016

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

42 Herculis
Dec. 49° 06′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 27	W	S	16 36 18·19
June 18	W	S	18·19
19	W	N	18·32
July 5	E	S	18·15

Mean 18·213
Δ_2 −·001
Mean R.A. 16 36 18·212

ζ Herculis
Dec. 31° 46′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	16 37 53·65
27	W	S	53·61
June 13	E	N	53·63
15	E	S	53·63
18	W	N	53·60
19	W	S	53·66
July 4	E	S	53·60
5	E	S	53·57
6	E	N	53·58
11	E	N	53·59

Mean 53·612
Δ_1 −·001
Δ_2 ·001
Mean R.A. 16 37 53·612

B.J. 626
Dec. 39° 06′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	16 39 48·53
26	W	N	48·56
27	W	S	48·62
June 13	E	N	48·61
15	E	S	48·64
18	W	N	48·59
19	W	S	48·61
25	W	S	48·63
28	E	S	48·60
29	E	S	48·56
July 4	E	S	48·56
5	E	S	48·61
6	E	N	48·62
11	E	N	48·60
13	E	N	48·60
19	E	S	48·60

B.J. 626
(continued)

h m s
Mean 16 39 48·596
Δ_1 ·001
Δ_2 ·001
Mean R.A. 16 39 48·598

B.D. 79·511
Dec. 79° 05′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	16 42 58·75r
28	E	S	58·92
29	E	S	58·87r
July 11	E	N	58·80r
13	E	N	58·67r
19	E	S	58·80

Mean 58·802
Δ_2 ·019
Mean R.A. 16 42 58·821

B.J. 627
Dec. 56° 57′

Date	Clamp	Observer	Mean R.A. 1910·0
May 19	E	S	16 43 35·10
26	W	N	35·19
27	W	S	35·23
June 13	E	S	35·28
18	W	S	35·30
19	W	N	35·37
July 4	E	S	35·29
5	E	S	35·24
6	E	N	35·19
26	W	S	35·25

Mean 35·244
Δ_1 ·003
Δ_2 ·001
Mean R.A. 16 43 35·248

Groombridge 2391
Dec. 77° 40′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	16 47 05·69
29	E	S	05·63
July 11	E	N	05·77
19	E	S	05·67

Groombridge 2391
(continued)

h m s
Mean 16 47 05·690
Δ_2 ·014
Mean R.A. 16 47 05·704

B. J. 629
Dec. 15° 07′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	16 47 58·93
June 13	E	N	59·11
15	E	S	59·05
19	W	S	58·95
July 4	E	S	58·94
5	E	S	58·97
6	E	N	58·94
26	W	S	58·93

Mean 58·977
Δ_1 −·003
Δ_2 ·001
Mean R.A. 16 47 58·975

53 Herculis
Dec. 31° 51′

Date	Clamp	Observer	Mean R.A. 1910·0
May 26	W	N	16 49 33·31
27	W	S	33·27
June 13	E	N	33·18
15	E	S	33·24
18	W	N	33·27
19	W	S	33·25
29	E	S	33·18
July 4	E	S	33·21
5	E	S	33·21
6	E	N	33·16
11	E	N	33·24
13	E	N	33·27
16	E	S	33·19
19	E	S	33·24
26	W	S	33·21

Mean 33·229
Δ_2 ·001
Mean R.A. 16 49 33·230

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

Groombridge 2411
Dec. 73° 16′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 25	W	S	16 58 03·68
28	E	S	03·26
29	E	S	03·43
July 11	E	N	03·45
13	E	N	03·38
19	E	S	03·47
Aug. 12	W	N	03·67

Mean 03·477
Δ_2 ·007
Mean R.A. 16 58 03·484

***d* Herculis**
Dec. 33° 42′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	16 58 16·88
June 4	W	S	16·98
July 4	E	S	16·95
5	E	S	16·95
6	E	N	16·97
16	E	S	16·98
26	W	S	16·97

Mean 16·954
Δ_1 ·002
Δ_2 ·002
Mean R.A. 16 58 16·958

B.J. 635
Dec. 12° 52′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	17 01 12·26
June 4	W	S	12·25
July 4	E	S	12·32
5	E	S	12·21
6	E	N	12·21
11	E	N	12·23
13	E	N	12·19
16	E	S	12·27
26	W	S	12·22r
Aug. 12	W	N	12·23

Mean 12·239
Δ_1 ·003
Δ_2 ·000
Mean R.A. 17 01 12·242

B.D. 75·612
Dec. 75° 21′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 11	E	N	17 03 13·28
13	E	N	13·31
19	E	S	13·16
Aug. 12	W	N	13·58

Mean 13·333
Δ_2 ·005
Mean R.A. 17 03 13·338

Groombridge 2427
Dec. 75° 25′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	17 04 29·45
28	E	S	29·38
29	E	S	29·29
July 13	E	N	29·46
19	E	S	29·42
Aug. 12	W	N	29·61

Mean 29·435
Δ_2 ·008
Mean R.A. 17 04 29·443

B.J. 636
Dec. 40° 38′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	17 04 50·51
June 4	W	S	50·50
July 5	E	S	50·49
6	E	N	50·51
16	E	S	50·50
26	W	S	50·53

Mean 50·507
Δ_1 —·002
Δ_2 ·001
Mean R.A. 17 04 50·506

B.J. 640
Dec. 14° 30′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 27	W	S	17 10 32·66
June 4	W	S	32·62
July 4	E	S	32·65
5	E	S	32·59
11	E	N	32·59
26	W	S	32·55
Aug. 12	W	N	32·56

Mean 32·603
Δ_1 ·004
Δ_2 ·001
Mean R.A. 17 10 32·608

B.J. 643
Dec. 36° 55′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	17 11 54·74
June 4	W	S	54·73
7	W	S	54·66
25	W	S	54·60r
28	E	S	54·74
29	E	S	54·71r
July 4	E	S	54·73
5	E	S	54·70
11	E	N	54·70
13	E	N	54·76
16	E	S	54·72
19	E	S	54·69
26	W	S	54·67
Aug. 12	W	N	54·69
19	E	N	54·70

Mean 54·703
Δ_1 —·001
Δ_2 ·001
Mean R.A. 17 11 54·703

***u* Herculis**
Dec. 33° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
June 4	W	S	17 13 60·06
July 4	E	S	60·03
5	E	S	59·97
16	E	S	60·01
26	W	S	59·98

Mean 60·010
Δ_2 ·002
Mean R.A. 17 14 00·012

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

e Herculis
Dec. 37° 23′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
May 27	W	S	17 14 34·00
June 25	W	S	34·04
28	E	S	33·94r
29	E	S	34·00
July 11	E	N	34·02r
13	E	N	34·04r
19	E	S	33·98r
Aug. 12	W	N	34·02
19	E	N	34·01

Mean 34·006
Δ_2 ·001

Mean R.A. 17 14 34·007

w Herculis
Dec. 32° 35′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	17 17 17·44
June 4	W	S	17·44
7	W	S	17·42
25	W	S	17·51
28	E	S	17·46
29	E	S	17·43
July 4	E	S	17·47
5	E	S	17·44
13	E	N	17·47
16	E	S	17·43
19	E	S	17·45
26	W	S	17·45
Aug. 12	W	N	17·47
19	E	N	17·44

Mean 17·451
Δ_1 −·004
Δ_2 ·001

Mean R.A. 17 17 17·448

ρ Herculis
Dec. 37° 14′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	17 20 34·63
June 4	W	S	34·68
7	W	S	34·58
25	W	S	34·69

ρ Herculis.
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 28	E	S	17 20 34·60
29	E	S	34·62
July 4	E	S	34·62
5	E	S	34·60
11	E	N	34·76
13	E	N	34·64
16	E	S	34·63
19	E	S	34·63
26	W	S	34·60
Aug. 12	W	N	34·64
19	E	N	34·65r

Mean 34·638
Δ_2 ·001

Mean R.A. 17 20 34·639

B.J. 650
Dec. 48° 20′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	17 24 21·11
June 25	W	S	21·03
28	E	S	20·96
29	E	S	21·00r
July 4	E	S	21·06
5	E	S	20·97
11	E	N	20·95
13	E	N	21·02
16	E	S	20·99
19	E	S	21·00r
26	W	S	21·05
Aug. 7	W	S	21·07r
12	W	N	21·08
19	E	N	21·09

Mean 21·027
Δ_1 ·003
Δ_2 ·002

Mean R.A. 17 24 21·032

Groombridge 2456
Dec. 80° 13′

Date	Clamp	Observer	Mean R.A. 1910·0
June 25	W	S	17 26 25·41
28	E	S	25·41
29	E	S	25·37

Groombridge 2456
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 11	E	N	17 26 25·41
13	E	N	25·57
19	E	S	25·45
Aug. 7	W	S	25·41
12	W	N	25·66
19	E	N	25·69

Mean 25·487
Δ_2 ·010

Mean R.A. 17 26 25·497

λ Herculis
Dec. 26° 11′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	17 27 06·04
July 4	E	S	06·02
5	E	S	06·01
16	E	S	06·06
26	W	S	06·01

Mean 06·028
Δ_1 ·004
Δ_2 ·002

Mean R.A. 17 27 06·034

B.J. 653
Dec. 52° 22′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	17 28 23·83
June 7	W	S	23·84
25	W	S	23·92
28	E	S	24·02
29	E	S	23·83
July 4	E	S	23·90
5	E	S	23·80
16	E	S	23·85
19	E	S	23·88
26	W	S	23·84
Aug. 7	W	S	23·81
12	W	N	23·87
19	E	N	23·94

Mean 23·872
Δ_1 −·002
Δ_2 ·002

Mean R.A. 17 28 23·872

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 655
Dec. 55° 15′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 25	W	S	17 30 24·11
28	E	S	24·12
29	E	S	24·09
July 19	E	S	24·13
Aug. 7	W	S	24·12
12	W	N	24·07

Mean 24·107
Δ_1 −·005
Δ_2 ·002

Mean R.A. 17 30 24·104

B.J. 657
Dec. 55° 14′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 19	E	N	17 30 29·500

Δ_1 −·002
Δ_2 ·002

Mean R.A. 17 30 29·500

B.J. 656
Dec. 12° 37′

Date	Clamp	Observer	Mean R.A. 1910·0
July 5	E	S	17 30 45·35r
16	E	S	45·40
26	W	S	45·39

Mean 45·380
Δ_1 −·004
Δ_2 ·002

Mean R.A. 17 30 45·378

B.J. 663
Dec. 46° 03′

Date	Clamp	Observer	Mean R.A. 1910·0
May 27	W	S	17 36 55·30
June 7	W	S	55·46
25	W	S	55·38r
28	E	S	55·39r
29	E	S	55·41

B.J. 663
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 4	E	S	17 36 55·37
5	E	S	55·36
13	E	N	55·48
16	E	S	55·46
19	E	S	55·39
26	W	S	55·41
Aug. 7	W	S	55·37
12	W	N	55·40
19	E	N	55·42

Mean 55·400
Δ_1 −·004
Δ_2 ·002

Mean R.A. 17 36 55·398

B.D. 72·800
Dec. 72° 30′

Date	Clamp	Observer	Mean R.A. 1910·0
July 13	E	N	17 38 51·00
19	E	S	50·89
Aug. 7	W	S	50·84r
12	W	N	50·99
19	E	N	51·20

Mean 50·984
Δ_2 ·002

Mean R.A. 17 38 50·986

B.J. 667
Dec. 27° 46′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	17 42 56·11
July 4	E	S	56·14
5	E	S	56·13
16	E	S	56·11r
26	W	S	56·14

Mean 56·126
Δ_1 −·001
Δ_2 ·002

Mean R.A. 17 42 56·127

B.J. 670
Dec. 72° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 13	E	N	17 43 32·30
19	E	S	32·15
Aug. 7	W	S	32·19
12	W	N	32·23
19	E	N	32·17

Mean 32·208
Δ_1 ·004
Δ_2 ·002

Mean R.A. 17 43 32·214

87 Herculis
Dec. 25° 39′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	17 45 10·14
July 4	E	S	10·19
5	E	S	10·14r
13	E	N	10·24
16	E	S	10·16
26	W	S	10·15r
Aug. 8	W	N	10·13
12	W	N	10·15
19	E	N	10·17

Mean 10·163
Δ_2 ·000

Mean R.A. 17 45 10·163

z Herculis
Dec. 48° 25′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	17 47 42·01
July 4	E	S	42·02
5	E	S	41·97
13	E	N	41·99
16	E	S	41·99
19	E	S	41·99
26	W	S	42·01
Aug. 7	W	S	41·99
8	W	N	42·09
12	W	N	42·01
19	E	N	41·95

Mean 42·002
Δ_2 ·001

Mean R.A. 17 47 42·003

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

168 H^{1}. Herculis
Dec. 40° 00′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 7	W	S	17 49 08·98
July 4	E	S	08·91
5	E	S	08·92
13	E	N	08·97
16	E	S	08·96
19	E	S	08·96
26	W	S	08·89
Aug. 7	W	S	08·94
8	W	N	08·96
12	W	N	09·00
19	E	N	08·98

Mean 08·952
Δ_2 ·001

Mean R.A. 17 49 08·953

89 Herculis
Dec. 26° 04′

Date	Clamp	Observer	Mean R.A. 1910·0
July 4	E	S	17 51 47·29
5	E	S	47·27
13	E	N	47·34
16	E	S	47·33
26	W	S	47·31
Aug. 8	W	N	47·23
12	W	N	47·28
19	E	N	47·27

Mean 47·290
Δ_1 −·004
Δ_2 ·000

Mean R.A. 17 51 47·286

B.J. 671
Dec. 56° 53′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	17 51 58·270

Δ_1 ·003
Δ_2 −·003

Mean R.A. 17 51 58·270

B.J. 672
Dec. 37° 16′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 7	W	S	17 53 09·97
July 4	E	S	09·93
5	E	S	09·95
13	E	N	09·93
16	E	S	09·96
26	W	S	09·98

Mean 09·953
Δ_1 ·001
Δ_2 ·002

Mean R.A. 17 53 09·956

B.J. 675
Dec. 76° 59′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	17 53 28·49
Aug. 7	W	S	28·69
12	W	N	28·52
19	E	N	28·63

Mean 28·583
Δ_1 ·000
Δ_2 ·000

Mean R.A. 17 53 28·583

B.J. 674
Dec. 29° 15′

Date	Clamp	Observer	Mean R.A. 1910·0
July 5	E	S	17 54 16·000

Δ_1 −·005
Δ_2 ·003

Mean R.A. 17 54 15·998

B.J. 676
Dec. 51° 30′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	17 54 30·92
July 4	E	S	30·90
26.	W	S	30·87

Mean 30·897
Δ_1 −·003
Δ_2 ·002

Mean R.A. 17 54 30·896

B.D. 78·616
Dec. 78° 19′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 19	E	S	17 55 14·44
Aug. 7	W	S	14·64
8	W	N	14·85
12	W	N	14·74
19	E	N	14·53

Mean 14·640
Δ_2 −·006

Mean R.A. 17 55 14·634

ψ^2 Draconis
Dec. 72° 01′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	17 56 44·61
Aug. 7	W	S	44·58
8	W	N	44·71
19	E	N	44·55
29	E	N	44·65

Mean 44·620
Δ_2 ·002

Mean R.A. 17 56 44·622

B.J. 681
Dec. 28° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
July 5	E	S	18 04 01·90
16	E	S	01·87
26	W	S	01·89
Aug. 19	E	N	01·88
26	E	N	01·91
29	E	N	01·88

Mean 01·888
Δ_1 ·001
Δ_2 ·000

Mean R.A. 18 04 01·889

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

40 Draconis
Dec. 79° 59′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 19	E	S	18 06 46·72
28	W	N	47·00
Aug. 7	W	S	46·92
8	W	N	46·71
12	W	N	46·85
19	E	N	47·05
26	E	N	47·04
29	E	N	46·84

Mean 46·891
Δ_2 −·004

Mean R.A. 18 06 46·887

B.J. 684
Dec. 42° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	18 12 50·80
July 16	E	S	50·78
19	E	S	50·85
26	W	S	50·78
28	W	N	50·75
Aug. 2	W	S	50·79
7	W	S	50·78
8	W	N	50·76
12	W	N	50·79
19	E	N	50·71
26	E	N	50·89
29	E	N	50·76

Mean 50·787
Δ_1 −·004
Δ_2 ·000

Mean R.A. 18 12 50·783

446 B.Herculis
Dec. 23° 14′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	18 18 23·49
July 16	E	S	23·46
26	W	S	23·49
28	W	N	23·43
Aug. 2	W	S	23·44
8	W	N	23·44
12	W	N	23·52
19	E	N	23·46
26	E	N	23·55
29	E	N	23·47

446 B. Herculis (continued)

h m s
Mean 18 18 23·475
Δ_2 ·000

Mean R.A. 18 18 23·475

B.J. 690
Dec. 21° 44′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	18 19 51·75
July 16	E	S	51·74
26	W	S	51·75
28	W	N	51·76
Aug. 2	W	S	51·76r
8	W	N	51·72
12	W	N	51·73
19	E	N	51·76
20	E	S	51·77
26	E	N	51·77
29	E	N	51·78

Mean 51·754
Δ_1 ·003
Δ_2 ·000

Mean R.A. 18 19 51·757

μ Lyrae
Dec. 39° 27′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	18 21 15·87
July 16	E	S	15·84
26	W	S	15·88r
Aug. 2	W	S	15·94
8	W	N	15·83
19	E	N	15·91
20	E	S	15·93
26	E	N	15·94
29	E	N	15·92

Mean 15·896
Δ_2 ·000

Mean R.A. 18 21 15·896

B.J. 693
Dec. 71° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 19	E	S	18 22 03·06
Aug. 29	E	N	02·93
Sept.	E	S	02·95

Mean 02·980
Δ_1 −·001
Δ_2 ·015

Mean R.A. 18 22 02·994

B.J. 694
Dec. 58° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	18 22 35·74
July 16	E	S	35·65
26	W	S	35·80
28	W	N	35·90
Aug. 8	W	N	35·71
20	E	S	35·76
26	E	N	35·73

Mean 35·756
Δ_1 −·004
Δ_2 ·000

Mean R.A. 18 22 35·752

B.J. 695
Dec. 72° 42′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 7	W	S	18 22 40·81
12	W	N	40·82
19	E	N	40·96
29	E	N	40·68

Mean 40·818
Δ_1 −·004
Δ_2 −·003

Mean R.A. 18 22 40·811

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 699
Dec. 38° 42′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 7	W	S	18 33 53·47
July 16	E	S	53·42r
26	W	S	53·45
28	W	N	53·47
Aug. 2	W	S	53·45r
12	W	N	53·47
19	E	N	53·47
20	E	S	53·45r
26	E	N	53·46
29	E	N	53·45r

Mean 53·456
Δ_1 ·004
Δ_2 ·000
Mean R.A. 18 33 53·460

B.J. 700
Dec. 77° 29′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	18 34 06·02
Aug. 7	W	S	06·05
8	W	N	06·28
11	W	S	06·17
Sept. 1	E	S	06·13

Mean 06·130
Δ_1 ·004
Δ_2 ·000
Mean R.A. 18 34 06·134

B.J. 703
Dec. 20° 28′

Date	Clamp	Observer	Mean R.A. 1910·0
July 16	E	S	18 41 47·27
26	W	S	47·28
30	W	N	47·35
Aug. 2	W	S	47·29
8	W	N	47·25
12	W	N	47·32
20	E	S	47·28
26	E	N	47·31
29	E	N	47·29
Sept. 2	E	N	47·27

Mean 47·291
Δ_1 ·002
Δ_2 ·000
Mean R.A. 18 41 47·293

111 Herculis
Dec. 18° 05′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 16	E	S	18 43 02·77
26	W	S	02·79
28	W	N	02·75
30	W	N	02·84
Aug. 2	W	S	02·79
12	W	N	02·76
19	E	N	02·79
20	E	S	02·77
26	E	N	02·84
29	E	N	02·81
Sept. 2	E	N	02·75

Mean 02·787
Δ_2 ·000
Mean R.A. 18 43 02·787

Bradley 2382
Dec. 70° 42′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	18 44 11·64
Aug. 7	W	S	11·67
8	W	N	11·64
11	W	S	11·76
12	W	N	11·76
19	E	N	11·97
29	E	N	11·70
Sept. 1	E	S	11·63
2	E	N	11·70

Mean 11·719
Δ_2 ·001
Mean R.A. 18 44 11·720

204 B. Draconis
Dec. 52° 53′

Date	Clamp	Observer	Mean R.A. 1910·0
July 16	E	S	18 44 42·33
26	W	S	42·38
28	W	N	42·42
30	W	N	42·47
Aug. 2	W	S	42·39
20	E	S	42·39
26	E	N	42·33

Mean 42·387
Δ_2 ·000
Mean R.A. 18 44 42·387

B.J. 705
Dec. 33° 15′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 16	E	S	18 46 45·42
19	E	S	45·40
26	W	S	45·39
28	W	N	45·37
Aug. 2	W	S	45·42
8	W	N	45·40
11	W	S	45·38
12	W	N	45·48
19	E	N	45·44
20	E	S	45·32
26	E	N	45·38
29	E	N	45·36
Sept. 1	E	S	45·40
2	E	N	45·40

Mean 45·397
Δ_1 ·000
Δ_2 ·000
Mean R.A. 18 46 45·397

Groombridge 2719
Dec. 73° 59′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	18 48 01·57
Aug. 7	W	S	01·66
8	W	N	01·66
11	W	S	01·62
12	W	N	01·48
19	E	N	01·61
29	E	N	01·60
Sept. 1	E	S	01·43
2	E	N	01·69

Mean 01·591
Δ_2 ·001
Mean R.A. 18 48 01·592

50 Draconis
Dec. 75° 20′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	18 49 16·89
Aug. 7	W	S	16·90
8	W	N	17·10
11	W	S	17·06
19	E	N	16·86

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

50 Draconis (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 29	E	N	18 49 17·02
Sept. 1	E	S	16·89
2	E	N	17·07
9	E	N	17·20

Mean 16·999
Δ₁ −·002
Δ₂ ·005

Mean R.A. 18 49 17·002

B.J. 707
Dec. 59° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
July 16	E	S	18 49 52·36
26	W	S	52·48
28	W	N	52·38
30	W	N	52·49
Aug. 2	W	S	52·51
20	E	S	52·34
26	E	N	52·31

Mean 52·410
Δ₁ ·000
Δ₂ ·000

Mean R.A. 18 49 52·410

B.D. 79·604
Dec. 79° 50′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	18 51 59·91
Aug. 7	W	S	59·89
8	W	N	60·25
12	W	N	60·14
Sept. 1	E	S	59·93
2	E	N	60·12

Mean 60·040
Δ₂ ·000

Mean R.A. 18 52 00·040

B.J. 711
Dec. 43° 50′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 16	E	S	18 52 35·76
26	W	S	35·78
28	W	N	35·79
30	W	N	35·72
Aug. 2	W	S	35·77
19	E	N	35·79
20	E	S	35·79
26	E	N	35·71
29	E	N	35·75

Mean 35·762
Δ₁ ·002
Δ₂ ·000

Mean R.A. 18 52 35·764

B.J. 714
Dec. 71° 11′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 8	W	N	18 55 30·22
12	W	N	29·99
Sept. 1	E	S	30·19
2	E	N	30·27
9	E	N	30·31

Mean 30·196
Δ₁ −·001
Δ₂ ·000

Mean R.A. 18 55 30·195

B.J. 713
Dec. 32° 34′

Date	Clamp	Observer	Mean R.A. 1910·0
July 16	E	S	18 55 34·62
26	W	S	34·65
28	W	N	34·56
30	W	N	34·61
Aug. 19	E	N	34·73
20	E	S	34·61
26	E	N	34·61
29	E	N	34·60

Mean 34·624
Δ₁ −·003
Δ₂ ·000

Mean R.A. 18 55 34·621

B.J. 716
Dec. 13° 44′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 7	W	S	19 01 16·400

Δ₁ ·002
Δ₂ ·003

Mean R.A. 19 01 16·405

B.J. 719
Dec. 35° 58′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	19 04 05·38
July 16	E	S	05·38
19	E	S	05·37
26	W	S	05·38
28	W	N	05·33
30	W	N	05·42
Aug. 2	W	S	05·35
7	W	S	05·33
8	W	N	05·37
11	W	S	05·36
12	W	N	05·37
19	E	N	05·36
20	E	S	05·41
26	E	N	05·40
29	E	N	05·38
Sept. 1	E	S	05·41
2	E	N	05·31
9	E	N	05·39

Mean 05·372
Δ₁ ·003
Δ₂ ·000

Mean R.A. 19 04 05·375

19 Lyrae
Dec. 31° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
July 16	E	S	19 08 18·82
26	W	S	18·91
Aug. 20	E	S	18·91r
26	E	N	18·84

Mean 18·870
Δ₂ ·001

Mean R.A. 19 08 18·871

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 725
Dec. 11° 26′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 16	E	S	19 13 35·51
26	W	S	35·51
Aug. 19	E	N	35·48
20	E	S	35·50
26	E	N	35·42
Mean			35·484
Δ_1			·000
Δ_2			·000
Mean R.A.			19 13 35·484

B.J. 726
Dec. 53° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
July 16	E	S	19 15 01·29
26	W	S	01·39
28	W	N	01·36
Aug. 8	W	N	01·40
12	W	N	01·33
19	E	N	01·37
20	E	S	01·34
26	E	N	01·27
29	E	N	01·29
Sept. 1	E	S	01·35
2	E	N	01·44
9	E	N	01·47
16	W	N	01·38
Mean			01·360
Δ_1			·004
Δ_2			·000
Mean R.A.			19 15 01·364

159 B.Lyrae
Dec. 40° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	19 15 57·60
July 16	E	S	57·53
26	W	S	57·53
Aug. 20	E	S	57·60
Mean			57·565
Δ_2			·002
Mean R.A.			19 15 57·567

B.J. 729
Dec. 73° 11′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 7	W	S	19 17 17·43
8	W	N	17·46
11	W	S	17·45
12	W	N	17·42
19	E	N	17·32
29	E	N	17·31
Sept. 1	E	S	17·30
9	E	N	17·43
Mean			17·390
Δ_1			·002
Δ_2			−·001
Mean R.A.			19 17 17·391

***b* Aquilae**
Dec. 11° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	19 20 40·71
July 16	E	S	40·69
26	W	S	40·70
30	W	N	40·67
Aug. 2	W	S	40·61
12	W	N	40·71
19	E	N	40·69
26	E	N	40·73
29	E	N	40·75
Sept. 2	E	N	40·70
9	E	N	40·70
13	E	S	40·76
14	E	N	40·79
16	W	N	40·67
26	W	N	40·74
30	W	N	40·73
Mean			40·709
Δ_1			·000
Δ_2			−·001
Mean R.A.			19 20 40·708

21 B.Vulpeculae
Dec. 24° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	19 21 42·25
July 16	E	S	42·26
26	W	S	42·31r
28	W	N	42·31
30	W	N	42·28

21 B.Vulpeculae
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 2	W	S	19 21 42·21
8	W	N	42·22
12	W	N	42·27
20	E	S	42·28
26	E	N	42·30
29	E	N	42·31
Sept. 2	E	N	42·27
9	E	N	42·32
13	E	S	42·30
14	E	N	42·31r
16	W	N	42·29r
26	W	N	42·29
30	W	N	42·29r
Mean			42·282
Δ_2			−·001
Mean R.A.			19 21 42·281

4 Cygni
Dec. 36° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	19 22 54·59
July 16	E	S	54·57
26	W	S	54·62
28	W	N	54·64
30	W	N	54·66
Aug. 2	W	S	54·60
7	W	S	54·61
8	W	N	54·58
11	W	S	54·62
12	W	N	54·62
20	E	S	54·61
26	E	N	54·60
29	E	N	54·63
Sept. 1	E	S	54·62
2	E	N	54·61
9	E	N	54·66
13	E	S	54·64
14	E	N	54·64
16	W	N	54·62
26	W	N	54·62
30	W	N	54·64
Mean			54·619
Δ_2			·000
Mean R.A.			19 22 54·619

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.D. 76·734
Dec. 76° 23′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 7	W	S	19 24 46·35
8	W	N	46·27
11	W	S	46·31
12	W	N	46·26
29	E	N	46·25
Sept. 1	E	S	46·16
9	E	N	46·24
13	E	S	46·18
17	W	S	46·41

Mean 46·270
Δ_2 −·001

Mean R.A. 19 24 46·269

α Vulpeculae
Dec. 24° 29′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	19 24 57·63
July 16	E	S	57·63 r
26	W	S	57·62
28	W	N	57·64
30	W	N	57·66
Aug. 2	W	S	57·66 r
20	E	S	57·64
26	E	N	57·57
Sept. 2	E	N	57·62
8	E	S	57·61
14	E	N	57·68
16	W	N	57·58
19	W	N	57·63
26	W	N	57·64
30	W	N	57·60

Mean 57·627
Δ_1 −·004
Δ_2 ·000

Mean R.A. 19 24 57·623

B.J. 732
Dec. 27° 46′

Date	Clamp	Observer	Mean R.A. 1910·0
July 16	E	S	19 27 05·50
28	W	N	05·59
30	W	N	05·50
Aug. 20	E	S	05·51
26	E	N	05·50

B.J. 732
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 2	E	N	19 27 05·54
8	E	S	05·50
14	E	N	05·56
19	W	N	05·46
26	W	N	05·49

Mean 05·515
Δ_1 ·002
Δ_2 −·001

Mean R.A. 19 27 05·516

B.J. 734
Dec. 79° 25′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 7	W	S	19 27 09·21
8	W	N	09·15
11	W	S	09·36
12	W	N	09·26
29	E	N	09·11
Sept. 1	E	S	09·16
9	E	N	09·25
13	E	S	09·27
17	W	S	09·47

Mean 09·249
Δ_1 ·003
Δ_2 −·002

Mean R.A. 19 27 09·250

B.J. 733
Dec. 51° 32′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	19 27 26·26
Aug. 2	W	S	26·27
Sept. 16	W	N	26·23
30	W	N	26·17

Mean 26·233
Δ_1 −·005
Δ_2 −·004

Mean R.A. 19 27 26·224

8 Cygni
Dec. 34° 16′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 16	E	S	19 28 25·60
28	W	N	25·66
30	W	N	25·64
Aug. 2	W	S	25·57
8	W	N	25·57
12	W	N	25·42
20	E	S	25·66
26	E	N	25·61
29	E	N	25·65
Sept. 1	E	S	25·62
2	E	N	25·59
8	E	S	25·62
9	E	N	25·61
14	E	N	25·62
16	W	N	25·62
17	W	S	25·67
19	W	N	25·59
26	W	N	25·60
30	W	N	25·60

Mean 25·606
Δ_2 −·001

Mean R.A. 19 28 25·605

B.D. 70·1073
Dec. 70° 48′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	19 31 43·65
Aug. 7	W	S	43·75
8	W	N	43·67
11	W	S	43·91
12	W	N	43·62
29	E	N	43·70
Sept. 1	E	S	43·58
9	E	N	43·65
13	E	S	43·89
14	E	N	43·79
17	W	S	43·87
26	W	N	43·74

Mean 43·735
Δ_2 ·000

Mean R.A. 19 31 43·735

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

ε Sagittae
Dec. 16° 16′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
June 7	W	S	19 33 12·92
July 16	E	S	12·91
Aug. 2	W	S	12·94
20	E	S	12·97
Mean			12·935
Δ_2			·002
Mean R.A.			19 33 12·937

B.D. 49·3059
Dec. 50° 02′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	19 33 31·17
28	W	N	31·25
30	W	N	31·19
Aug. 8	W	N	31·26
11	W	S	31·34
12	W	N	31·20
26	E	N	31·19
29	E	N	31·15
Sept. 1	E	S	31·19r
2	E	N	31·19
9	E	N	31·28
13	E	S	31·29
14	E	N	31·31
16	W	N	31·27r
17	W	S	31·29
19	W	N	31·19
26	W	N	31·26
30	W	N	31·29r
Mean			31·239
Δ_2			−·001
Mean R.A.			19 33 31·238

B.J. 738
Dec. 50° 01′

Date	Clamp	Observer	Mean R.A. 1910·0
July 16	E	S	19 34 01·62
19	E	S	01·63
28	W	N	01·61
30	W	N	01·74
Aug. 2	W	S	01·73
7	W	S	01·74
8	W	N	01·71

B.J. 738 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 11	W	S	19 34 01·71r
12	W	N	01·70
26	E	N	01·63
29	E	N	01·68
Sept. 1	E	S	01·63
2	E	N	01·66
9	E	N	01·71
13	E	S	01·78
14	E	N	01·71
16	W	N	01·70
17	W	S	01·65r
19	W	N	01·66r
26	W	N	01·63r
30	W	N	01·72
Mean			01·683
Δ_1			−·005
Δ_2			−·001
Mean R.A.			19 34 01·677

14 Cygni
Dec. 42° 37′

Date	Clamp	Observer	Mean R.A. 1910·0
June 7	W	S	19 36 30·70
July 19	E	S	30·65
28	W	N	30·70
Aug. 7	W	S	30·72
8	W	N	30·73
11	W	S	30·75r
12	W	N	30·70
26	E	N	30·67
29	E	N	30·67
Sept. 1	E	S	30·67r
2	E	N	30·71
9	E	N	30·67
13	E	S	30·70
19	W	N	30·65
30	W	N	30·68
Mean			30·691
Δ_2			−·001
Mean R.A.			19 36 30·690

β Sagittae
Dec. 17° 16′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 16	E	S	19 37 00·39
30	W	N	00·38
Aug. 2	W	S	00·46
20	E	S	00·42
Sept. 14	E	N	00·45
16	W	N	00·43
17	W	S	00·38
22	W	S	00·43
26	W	N	00·40
Mean			00·416
Δ_1			−·004
Δ_2			·001
Mean R.A.			19 37 00·413

10 Vulpeculae
Dec. 25° 33′

Date	Clamp	Observer	Mean R.A. 1910·0
July 28	W	N	19 39 58·33
30	W	N	58·39
Aug. 2	W	S	58·37
8	W	N	58·31
12	W	N	58·32
20	E	S	58·37
26	E	N	58·40
29	E	N	58·39
Sept. 2	E	N	58·38
9	E	N	58·39
13	E	S	58·39
14	E	N	58·40
15	E	S	58·34
16	W	N	58·37
17	W	S	58·37
19	W	N	58·43
22	W	S	58·36
26	W	N	58·40
30	W	N	58·41
Mean			58·375
Δ_2			−·001
Mean R.A.			19 39 58·374

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 740
Dec. 37° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 19	E	S	19 41 01·80
28	W	N	01·77
30	W	N	01·85
Aug. 2	W	S	01·81
7	W	S	01·84
11	W	S	01·82
12	W	N	01·77
20	E	S	01·84
26	E	N	01·82
29	E	N	01·89
Sept. 1	E	S	01·82
2	E	N	01·81
9	E	N	01·77
13	E	S	01·87
14	E	N	01·88
15	E	S	01·82
16	W	N	01·88
17	W	S	01·86
19	W	N	01·82
22	W	S	01·85
26	W	N	01·81
30	W	N	01·85

Mean 01·830
Δ_1 ·003
Δ_2 ·000

Mean R.A. 19 41 01·833

B.J. 742
Dec. 44° 55′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 19	E	S	19 42 09·70r
28	W	N	09·66
30	W	N	09·77
Aug. 2	W	S	09·70
7	W	S	09·72
8	W	N	09·78
11	W	S	09·73
12	W	N	09·67
20	E	S	09·69
26	E	N	09·71
29	E	N	09·69
Sept. 1	E	S	09·72
2	E	N	09·69
9	E	N	09·76
15	E	S	09·76
16	W	N	09·69
17	W	S	09·70

B.J. 742
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 19	W	N	19 42 09·66
22	W	S	09·72
26	W	N	09·72
30	W	N	09·70

Mean 09·711
Δ_1 −·004
Δ_2 −·001

Mean R.A. 19 42 09·706

B.J. 743
Dec. 18° 19′

Date	Clamp	Observer	Mean R.A. 1910·0
July 30	W	N	19 43 22·47
Aug. 2	W	S	22·50
12	W	N	22·46
20	E	S	22·55
26	E	N	22·43
29	E	N	22·45
Sept. 2	E	N	22·56
9	E	N	22·46
13	E	S	22·49r
15	E	S	22·52
16	W	N	22·50r
17	W	S	22·48r
19	W	S	22·52
22	W	S	22·49
26	W	N	22·49
30	W	N	22·48

Mean 22·491
Δ_1 ·000
Δ_2 ·000

Mean R.A. 19 43 22·491

ζ Sagittae
Dec. 18° 55′

Date	Clamp	Observer	Mean R.A. 1910·0
July 28	W	N	19 44 59·02
30	W	N	58·94
Aug. 2	W	S	59·01r
12	W	N	58·92
20	E	S	58·96
26	E	N	58·95
29	E	N	58·92

ζ Sagittae
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 2	E	N	19 44 58·97
9	E	N	58·90
13	E	S	58·92
14	E	N	58·96
15	E	S	58·97r
16	W	N	58·93
17	W	S	58·93
19	W	N	58·91r
22	W	S	58·94r
26	W	N	58·96
30	W	N	58·96r

Mean 58·948
Δ_2 −·001

Mean R.A. 19 44 58·947

B.J. 747
Dec. 70° 02′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	19 48 28·86
Aug. 7	W	S	28·83
8	W	N	29·14
12	W	N	28·90
29	E	N	29·00
Sept. 9	E	N	28·89
14	E	N	28·84
26	W	N	29·01

Mean 28·934
Δ_1 ·002
Δ_2 −·003

Mean R.A. 19 48 28·933

φ Aquilae
Dec. 11° 11′

Date	Clamp	Observer	Mean R.A. 1910·0
July 26	W	S	19 51 58·52
28	W	N	58·45
30	W	N	58·51
Aug. 2	W	S	58·50
8	W	N	58·57
12	W	N	58·52
19	E	N	58·54

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

φ Aquilae (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 20	E	S	19 51 58·55
26	E	N	58·54
29	E	N	58·56
Sept. 2	E	N	58·58
13	E	S	58·48
14	E	N	58·55
15	E	S	58·56
16	W	N	58·50
17	W	S	58·54
19	W	N	58·63
22	W	S	58·55
26	W	N	58·55
29	W	S	58·56
30	W	N	58·51
Mean			58·537
Δ_2			·000
Mean R.A.			19 51 58·537

B.J. 750
Dec. 52° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	19 53 18·17
28	W	N	18·15
30	W	N	18·18
Aug. 8	W	N	18·18
12	W	N	18·14
19	E	N	18·16
26	E	N	18·14
29	E	N	18·18
Sept. 2	E	N	18·22
9	E	N	18·27
14	E	N	18·16
15	E	S	18·20
16	W	N	18·24
17	W	S	18·24
19	W	N	18·20
22	W	S	18·21
26	W	N	18·22
29	W	S	18·20
30	W	N	18·19
Mean			18·192
Δ_1			·000
Δ_2			−·002
Mean R.A.			19 53 18·190

B.J. 752
Dec. 19° 15′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 26	W	S	19 54 45·32
28	W	N	45·31
30	W	N	45·27
Aug. 2	W	S	45·25
8	W	N	45·29
12	W	N	45·33
19	E	N	45·21
26	E	N	45·26
29	E	N	45·32
Sept. 2	E	N	45·31
9	E	N	45·25
13	E	S	45·28
14	E	N	45·27
15	E	S	45·31
16	W	N	45·35
17	W	S	45·25
19	W	N	45·27
22	W	S	45·29
29	W	S	45·27
30	W	N	45·26
Mean			45·283
Δ_1			−·005
Δ_2			·000
Mean R.A.			19 54 45·278

15 Vulpeculae
Dec. 27° 30′

Date	Clamp	Observer	Mean R.A. 1910·0
July 26	W	S	19 57 23·65
28	W	N	23·62
30	W	N	23·62
Aug. 2	W	S	23·61
8	W	N	23·53
12	W	N	23·60
19	E	N	23·60
26	E	N	23·63
29	E	N	23·64
Sept. 2	E	N	23·59
9	E	N	23·65
13	E	S	23·62
14	E	N	23·63
15	E	S	23·64
17	W	S	23·64
19	W	N	23·66
22	W	S	23·69
26	W	N	23·57
29	W	S	23·65
30	W	N	23·64

15 Vulpeculae (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Mean			19 57 23·624
Δ_2			−·001
Mean R.A.			19 57 23·623

B.D. 69·1084
Dec. 70° 07′

Date	Clamp	Observer	Mean R.A. 1910·0
July 19	E	S	19 58 55·20
Aug. 7	W	S	55·32
11	W	S	55·41
12	W	N	55·37
19	E	N	55·17
29	E	N	55·31
Sept. 9	E	N	55·35
10	E	S	55·30
13	E	S	55·35
14	E	N	55·16
15	E	S	55·32
17	W	S	55·39
26	W	N	55·39
29	W	S	55·31
Mean			55·311
Δ_2			·002
Mean R.A.			19 58 55·313

69 Draconis
Dec. 76° 14′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 11	W	S	20 02 08·84
19	E	N	08·90
Sept. 9	E	N	08·88
10	E	S	08·90
13	E	S	08·81
14	E	N	08·94
15	E	S	08·81
17	W	S	08·97
26	W	N	08·92
28	W	N	09·23
Mean			08·920
Δ_2			·004
Mean R.A.			20 02 08·924

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

b^2 Cygni
Dec. 36° 34′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 26	W	S	20 06 05·03
Aug. 7	W	S	05·01
Sept. 2	E	N	05·04
10	E	S	04·99
13	E	S	05·08
15	E	S	05·04
16	W	N	05·02
17	W	S	05·03
26	W	N	05·01
28	W	N	05·05
29	W	S	05·01
Mean			05·028
Δ_2			·000
Mean R.A.			20 06 05·028

20 Vulpeculae
Dec. 26° 13′

Date	Clamp	Observer	Mean R.A. 1910·0
July 26	W	S	20 08 14·25
Sept. 2	E	N	14·22
13	E	S	14·17
15	E	S	14·23
16	W	N	14·23
17	W	S	14·24
26	W	N	14·22
28	W	N	14·28
29	W	S	14·23
Oct. 11	W	S	14·21
Mean			14·228
Δ_2			·000
Mean R.A.			20 08 14·228

ρ Aquilae
Dec. 14° 55′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 13	E	S	20 10 06·78
15	E	S	06·75
17	W	S	06·75
29	W	S	06·76
Oct. 11	W	S	06·74
Mean			06·756
Δ_2			·002
Mean R.A.			20 10 06·758

30 Cygni
Dec. 46° 33′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 26	W	S'	20 10 28·26
Sept. 10	E	S	28·22
26	W	N	28·33
28	W	N	28·36
Mean			28·292
Δ_2			−·001
Mean R.A.			20 10 28·291

B.J. 757
Dec. 46° 28′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	20 10 47·79
Sept. 2	E	N	47·85
16	W	N	47·90
28	W	N	47·87
Mean			47·853
Δ_1			−·004
Δ_2			−·002
Mean R.A.			20 10 47·847

B.J. 759
Dec. 77° 26′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 7	W	S	20 11 56·08
Sept. 1	E	S	56·18
10	E	S	56·27
13	E	S	56·30
15	E	S	56·23
17	W	S	56·31
26	W	N	55·87
28	W	N	56·32
29	W	S	56·21
Oct. 11	W	S	56·28
Mean			56·205
Δ_1			−·004
Δ_2			·000
Mean R.A.			20 11 56·201

B.J. 760
Dec. 24° 24′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 26	W	S	20 12 56·04
28	W	N	56·06
30	W	N	56·00
Aug. 19	E	N	56·09
31	E	N	56·01
Sept. 2	E	N	56·04
8	E	S	55·96
15	E	S	55·97
16	W	N	55·90
Mean			56·008
Δ_1			−·005
Δ_2			−·001
Mean R.A.			20 12 56·002

176 B.Cygni
Dec. 39° 07′

Date	Clamp	Observer	Mean R.A. 1910·0
July 26	W	S	20 16 59·48
30	W	N	59·51
Aug. 7	W	S	59·47
11	W	S	59·44
19	E	N	59·48
29	E	N	59·46
31	E	N	59·43
Sept. 1	E	S	59·43
2	E	N	59·34
8	E	S	59·46
9	E	N	59·41
10	E	S	59·46
14	E	N	59·50
16	W	N	59·49
19	W	N	59·49
26	W	N	59·45
28	W	N	59·51
29	W	S	59·47
30	W	N	59·46
Oct. 7	W	N	59·45
10	W	N	59·45
11	W	S	59·48
Mean			59·460
Δ_2			−·001
Mean R.A.			20 16 59·459

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 765
Dec. 39° 58′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 26	W	S	20 18 59·81
30	W	N	59·84
Aug. 7	W	S	59·88
11	W	S	59·87r
19	E	N	59·94
20	E	S	59·88
29	E	N	59·86
31	E	N	59·89
Sept. 1	E	S	59·89r
2	E	N	59·90
8	E	S	59·87
9	E	N	59·91
10	E	S	59·85r
13	E	S	59·88
14	E	N	59·88r
15	E	S	59·86r
16	W	N	59·79r
17	W	S	59·88
19	W	N	59·89
22	W	S	59·84
26	W	N	59·84
28	W	N	59·76
29	W	S	59·84r
30	W	N	59·86
Oct. 7	W	N	59·84r
10	W	N	59·88

Mean 59·863
Δ_1 ·002
Δ_2 ·000

Mean R.A. 20 18 59·865

40 Cygni
Dec. 38° 09′

Date	Clamp	Observer	Mean R.A. 1910·0
July 26	W	S	20 24 14·18r
30	W	N	14·21
Aug. 7	W	S	14·21r
11	W	S	14·15
19	E	N	14·15
20	E	S	14·16
29	E	N	14·14
31	E	N	14·20
Sept. 1	E	S	14·15
2	E	N	14·22
8	E	S	14·18r

40 Cygni
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 10	E	S	20 24 14·16
13	E	S	14·14
14	E	N	14·09
15	E	S	14·17r
16	W	N	14·22
17	W	S	14·24
19	W	N	14·20
22	W	S	14·19r
26	W	N	14·13r
28	W	N	14·16r
29	W	S	14·15
30	W	N	14·13r
Oct. 7	W	N	14·16
10	W	N	14·14r
11	W	S	14·18r
12	E	N	14·12

Mean 14·168
Δ_2 ·000

Mean R.A. 20 24 14·168

41 Cygni
Dec. 30° 04′

Date	Clamp	Observer	Mean R.A. 1910·0
July 26	W	S	20 25 43·08
30	W	N	43·04
Aug. 7	W	S	43·02
11	W	S	43·02
19	E	N	43·07
20	E	S	43·08
29	E	N	43·09
31	E	N	43·11
Sept. 1	E	S	43·05
2	E	N	43·00
8	E	S	43·07
9	E	N	43·03
10	E	S	43·02
13	E	S	43·10
14	E	N	43·07
15	E	S	43·05
16	W	N	43·07
17	W	S	43·05
19	W	N	43·09
22	W	S	43·07
26	W	N	43·08
28	W	N	43·11
29	W	S	43·08
30	W	N	43·05

41 Cygni
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 7	W	N	20 25 43·10
10	W	N	43·07
11	W	S	43·06
12	E	N	43·10

Mean 43·065
Δ_1 −·003
Δ_2 ·000

Mean R.A. 20 25 43·062

ω^1 Cygni
Dec. 48° 39′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 7	W	S	20 27 16·23
11	W	S	16·28
20	E	S	16·25
29	E	N	16·25
31	E	N	16·25
Sept. 1	E	S	16·28
2	E	N	16·24
8	E	S	16·25
9	E	N	16·28
10	E	S	16·26
13	E	S	16·25
14	E	N	16·22
15	E	S	16·26
16	W	N	16·32
17	W	S	16·31
19	W	N	16·24
22	W	S	16·26
26	W	N	16·18
28	W	N	16·31
29	W	S	16·24
30	W	N	16·30
Oct. 7	W	N	16·27
10	W	N	16·25
11	W	S	16·30
12	E	N	16·40

Mean 16·267
Δ_2 ·000

Mean R.A. 20 27 16·267

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 768
Dec. 11° 00′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 30	W	N	20 28 54·80
Aug. 20	E	S	54·81
29	E	N	54·79
31	E	N	54·75
Sept. 2	E	N	54·86
8	E	S	54·79
13	E	S	54·82
14	E	N	54·83
15	E	S	54·81
16	W	N	54·81
17	W	S	54·80
19	W	N	54·78
21	W	N	54·81
22	W	S	54·77
26	W	N	54·74
28	W	N	54·81
29	W	S	54·84
30	W	N	54·81
Oct. 7	W	N	54·83
11	W	S	54·81
19	E	N	54·80
26	E	N	54·78
Mean			54·802
Δ_1			·000
Δ_2			·000
Mean R.A.			20 28 54·802

Groombridge 3241
Dec. 72° 14′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 7	W	S	20 30 24·33
11	W	S	24·32
19	E	N	24·48
29	E	N	24·26
Sept. 1	E	S	24·30
9	E	N	24·35
10	E	S	24·28
13	E	S	24·23
26	W	N	24·31
28	W	N	24·47
29	W	S	24·22
Oct. 10	W	N	24·25
12	E	N	24·51
Mean			24·332
Δ_1			−·004
Δ_2			·001
Mean R.A.			20 30 24·329

ζ Delphini
Dec. 14° 22′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 30	W	N	20 31 06·00
Aug. 20	E	S	06·03
31	E	N	06·00
Sept. 2	E	N	06·14
8	E	S	06·05r
14	E	N	06·10r
15	E	S	06·05
16	W	N	06·04r
17	W	S	06·03
19	W	N	06·08
21	W	N	06·07r
22	W	S	06·02
30	W	N	06·07
Oct. 7	W	N	06·06r
11	W	S	06·03r
19	E	N	06·08
26	E	N	06·08
Mean			06·055
Δ_2			−·001
Mean R.A.			20 31 06·054

B.J. 770
Dec. 74° 39′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 7	W	S	20 32 42·44
11	W	S	42·34
19	E	N	42·36
29	E	N	42·28
31	E	N	42·65
Sept. 1	E	S	42·27
9	E	N	42·23
10	E	S	42·30
13	E	S	42·23
15	E	S	42·43
17	W	S	42·43
26	W	N	42·28
28	W	N	42·54
29	W	S	42·26
Oct. 10	W	N	42·16
11	W	S	42·29
12	E	N	42·46
Mean			42·350
Δ_1			·001
Δ_2			·001
Mean R.A.			20 32 42·352

B.J. 771
Dec. 14° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 30	W	N	20 33 19·68
Aug. 20	E	S	19·71r
Sept. 2	E	N	19·77
8	E	S	19·70
14	E	N	19·73
16	W	N	19·66
19	W	N	19·72r
21	W	N	19·79
22	W	S	19·73r
30	W	N	19·71r
Oct. 7	W	N	19·76
19	E	N	19·79r
Mean			19·729
Δ_1			·001
Δ_2			−·001
Mean R.A.			20 33 19·729

29 Vulpeculae
Dec. 20° 53′

Date	Clamp	Observer	Mean R.A. 1910·0
July 30	W	N	20 34 30·10
Aug. 20	E	S	30·10
Sept. 2	E	N	30·20
8	E	S	30·08
13	E	S	30·14
14	E	N	30·13
16	W	N	30·14
17	W	S	30·09
19	W	N	30·17
21	W	N	30·13
22	W	S	30·13
26	W	N	30·07
28	W	N	30·11
30	W	N	30·11
Oct. 7	W	N	30·08
10	W	N	30·14
17	E	N	30·12
19	E	N	30·17
26	E	N	30·18
Mean			30·126
Δ_2			−·001
Mean R.A.			20 34 30·125

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

74 Draconis
Dec. 80° 47′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 29	E	N	20 34 42·03
31	E	N	42·08
Sept. 1	E	S	42·07rn
9	E	N	42·21
10	E	S	41·89
29	W	S	41·88nr
Oct. 11	W	S	42·01rn
Mean			42·024
Δ_2			·014
Mean R.A.			20 34 42·038

B.J. 774
Dec. 15° 36′

Date	Clamp	Observer	Mean R.A. 1910·0
July 30	W	N	20 35 27·44
Aug. 19	E	N	27·42
20	E	S	27·45
Sept. 2	E	N	27·53
8	E	S	27·47
14	E	N	27·49
15	E	S	27·48
16	W	N	27·49
17	W	S	27·45
19	W	N	27·45
21	W	N	27·50
22	W	S	27·46
26	W	N	27·48
28	W	N	27·49
30	W	N	27·51
Oct. 7	W	N	27·41
10	W	N	27·42
12	E	N	27·44
17	E	N	27·49
19	E	N	27·53
26	E	N	27·51
Mean			27·472
Δ_1			−·001
Δ_2			−·001
Mean R.A.			20 35 27·470

B.J. 777
Dec. 44° 57′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
July 30	W	N	20 38 21·78
Aug. 19	E	N	21·79
20	E	S	21·77
29	E	N	21·81
31	E	N	21·78
Sept. 1	E	S	21·81
2	E	N	21·74
8	E	S	21·77
9	E	N	21·72
10	E	S	21·77
14	E	N	21·78
16	W	N	21·73
19	W	N	21·76
21	W	N	21·83
22	W	S	21·77
26	W	N	21·81
28	W	N	21·83
29	W	S	21·82
30	W	N	21·69
Oct. 7	W	N	21·76
10	W	N	21·70
11	W	S	21·81
12	E	N	21·74
17	E	N	21·77
19	E	N	21·76
26	E	N	21·81
Mean			21·773
Δ_1			·004
Δ_2			−·001
Mean R.A.			20 38 21·776

B.J. 778
Dec. 14° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
July 30	W	N	20 39 15·46
Aug. 20	E	S	15·44
31	E	N	15·48
Sept. 2	E	N	15·43
9	E	N	15·45
13	E	S	15·43
14	E	N	15·39
15	E	S	15·41
16	W	N	15·41
17	W	S	15·41
19	W	N	15·46
21	W	N	15·47
22	W	S	15·42

B.J. 778
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 26	W	N	20 39 15·40
28	W	N	15·43
29	W	S	15·45
30	W	N	15·46
Oct. 7	W	N	15·49
10	W	N	15·39
11	W	S	15·42
12	E	N	15·40
17	E	N	15·52
19	E	N	15·43
26	E	N	15·46
Mean			15·438
Δ_1			·004
Δ_2			−·001
Mean R.A.			20 39 15·441

B.J. 780
Dec. 33° 38′

Date	Clamp	Observer	Mean R.A. 1910·0
July 30	W	N	20 42 34·08
Aug. 19	E	N	34·08
20	E	S	34·12
29	E	N	34·10
31	E	N	34·13
Sept. 1	E	S	34·15r
2	E	N	34·08
8	E	S	34·16
9	E	N	34·16
13	E	S	34·09r
14	E	N	34·09
16	W	N	34·09r
19	W	N	34·14
21	W	N	34·13r
22	W	S	34·13
26	W	N	34·14
28	W	N	34·08r
29	W	S	34·14r
30	W	N	34·10
Oct. 3	W	N	34·16
7	W	N	34·13r
10	W	N	34·08
11	W	S	34·13
12	E	N	34·18
17	E	N	34·18r
19	E	N	34·11
26	E	N	34·14r
Mean			34·122
Δ_1			−·004
Δ_2			−·001
Mean R.A.			20 42 34·117

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 782
Dec. 57° 15′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 10	E	S	20 43 06·99
15	E	S	07·09
17	W	S	07·16
Mean			07·080
Δ_1			−·003
Δ_2			·005
Mean R.A.			20 43 07·082

B.J. 784
Dec. 36° 10′

Date	Clamp	Observer	Mean R.A. 1910·0
July 30	W	N	20 43 54·13
Aug. 19	E	N	54·13
20	E	S	54·06r
29	E	N	54·21
31	E	N	54·12
Sept. 1	E	S	54·08
2	E	N	54·12
8	E	S	54·13r
9	E	N	54·11
13	E	S	54·17
14	E	N	54·13r
16	W	N	54·17
19	W	N	54·13r
21	W	N	54·17
22	W	S	54·14r
26	W	N	54·23r
29	W	S	54·13
30	W	N	54·13r
Oct. 7	W	N	54·11
10	W	N	54·13r
11	W	S	54·13r
12	E	N	54·23r
17	E	N	54·11
19	E	N	54·12r
26	E	N	54·06
Mean			54·135
Δ_1			·000
Δ_2			−·001
Mean R.A.			20 43 54·134

220 H¹. Draconis
Dec. 80° 13′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 29	E	N	20 51 41·84
Sept. 2	E	N	41·95
9	E	N	41·80
14	E	N	41·77
16	W	N	42·35
19	W	N	41·88
21	W	N	42·35
28	W	N	42·15
30	W	N	41·88
Oct. 7	W	N	42·00nr
10	W	N	41·76r
12	E	N	41·99nr
17	E	N	41·93nr
19	E	N	41·85nr
26	E	N	41·96nr
Mean			41·964
Δ_1			−·005
Δ_2			−·007
Mean R.A.			20 51 41·952

B.J. 788
Dec. 40° 49′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 11	W	S	20 53 49·04
20	E	S	49·03
29	E	N	48·93
31	E	N	48·97
Sept. 1	E	S	49·04
2	E	N	48·97
8	E	S	49·03
9	E	N	48·97
10	E	S	49·01
13	E	S	49·07
14	E	N	48·93
15	E	S	49·01
16	W	N	49·01
17	W	S	49·04
19	W	N	48·99
21	W	N	49·09
22	W	S	49·02
26	W	N	49·05
28	W	N	48·99
29	W	S	49·03
30	W	N	49·02
Oct. 7	W	N	49·06
10	W	N	49·01

B.J. 788
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 11	W	S	20 53 49·04
17	E	N	49·01
19	E	N	48·99
26	E	N	48·92
Mean			49·010
Δ_1			−·003
Δ_2			·000
Mean R.A.			20 53 49·007

Bradley 2748
Dec. 75° 35′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 11	W	S	20 55 48·71
29	E	N	48·46
31	E	N	48·64
Sept. 1	E	S	48·52
9	E	N	48·65
10	E	S	48·61
13	E	S	48·67
15	E	S	48·70
26	W	N	48·70
28	W	N	48·78
29	W	S	48·55
Oct. 10	W	N	48·50
11	W	S	48·63
12	E	N	48·46
17	E	N	48·53
19	E	N	48·49
26	E	N	48·68
Mean			48·605
Δ_2			·004
Mean R.A.			20 55 48·609

f^1 Cygni
Dec. 47° 10′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 20	E	S	20 56 45·86
Sept. 2	E	N	45·80
8	E	S	45·84
14	E	N	45·83
16	W	N	45·86

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

f^1 Cygni (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 17	W	S	20 56 45·91
19	W	N	45·79
21	W	N	45·99
22	W	S	45·88
28	W	N	45·93
30	W	N	45·88
Oct. 7	W	N	45·84
10	W	N	45·83
17	E	N	45·92
19	E	N	45·90
26	E	N	45·91

Mean 45·873
Δ_2 −·001

Mean R.A. 20 56 45·872

B.J. 792 Dec. 43° 34′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 11	W	S	21 01 39·35
20	E	S	39·37
31	E	N	39·38
Sept. 1	E	S	39·36
2	E	N	39·34
8	E	S	39·41
10	E	S	39·32
13	E	S	39·41
14	E	N	39·31
16	W	N	39·37
17	W	S	39·35
19	W	N	39·38
22	W	S	39·36
26	W	N	39·38
28	W	N	39·39
29	W	S	39·37
30	W	N	39·29
Oct. 7	W	N	39·30
10	W	N	39·35
11	W	S	39·41
12	E	N	39·36
17	E	N	39·36
19	E	N	39·31

Mean 39·358
Δ_1 ·000
Δ_2 ·000

Mean R.A. 21 01 39·358

B.J. 793 Dec. 38° 18′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 11	W	S	21 02 51·72
20	E	S	51·74
31	E	N	51·75
Sept. 2	E	N	51·75
9	E	N	51·76
10	E	S	51·69
14	E	N	51·75
16	W	N	51·72
19	W	N	51·73
26	W	N	51·68
28	W	N	51·71
30	W	N	51·76
Oct. 7	W	N	51·69
10	W	N	51·70
12	E	N	51·77
17	E	N	51·76
19	E	N	51·75

Mean 51·731
Δ_1 −·005
Δ_2 −·001

Mean R.A. 21 02 51·725

f^2 Cygni Dec. 47° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 03 30·07
Sept. 1	E	S	30·01
8	E	S	30·02
9	E	N	30·06
13	E	S	30·03
17	W	S	30·06
22	W	S	30·06
26	W	N	29·99
28	W	N	29·98
29	W	S	30·03
30	W	N	29·98
Oct. 7	W	N	30·00
10	W	N	29·96
11	W	S	30·02
17	E	N	29·94
19	E	N	29·95

Mean 30·010
Δ_2 −·001

Mean R.A. 21 03 30·009

Groombridge 3409 Dec. 71° 04′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 11	W	S	21 05 51·35
31	E	N	51·32
Sept. 1	E	S	51·28
9	E	N	51·33
10	E	S	51·36
13	E	S	51·44
14	E	N	51·31
15	E	S	51·37
17	W	S	51·34
21	W	N	51·38
26	W	N	51·37
28	W	N	51·45
29	W	S	51·39
Oct. 10	W	N	51·32
11	W	S	51·37
17	E	N	51·29
19	E	N	51·26

Mean 51·349
Δ_2 ·000

Mean R.A. 21 05 51·349

B.J. 795 Dec. 77° 46′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 1	E	S	21 07 18·81
10	E	S	18·93
13	E	S	18·95
14	E	N	18·81
15	E	S	18·94
17	W	S	19·06
26	W	N	19·03
28	W	N	18·99
29	W	S	18·78
Oct. 10	W	N	18·93
11	W	S	18·98
12	E	N	19·02
17	E	N	18·85
19	E	N	18·81

Mean 18·921
Δ_1 ·001
Δ_2 ·003

Mean R.A. 21 07 18·925

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 797
Dec. 29° 51′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 20	E	S	21 09 06·36
Sept. 9	E	N	06·32
16	W	N	06·34
17	W	S	06·31
22	W	S	06·28
26	W	N	06·27
Mean			06·313
Δ_1			·000
Δ_2			·000
Mean R.A.			21 09 06·313

B.J. 798
Dec. 59° 37′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 11	W	S	21 09 30·82
31	E	N	30·74
Sept. 1	E	S	30·75
8	E	S	30·77
10	E	S	30·76
14	E	N	30·65
15	E	S	30·70
19	W	N	30·75
21	W	N	30·82
28	W	N	30·75
29	W	S	30·79
30	W	N	30·78
Oct. 7	W	N	30·77
10	W	N	30·67
11	W	S	30·73
12	E	N	30·76
17	E	N	30·65
19	E	N	30·68
Mean			30·741
Δ_1			·004
Δ_2			–·001
Mean R.A.			21 09 30·744

B.J. 799
Dec. 37° 40′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 11	W	S	21 11 11·87
20	E	S	11·85
31	E	N	11·87
Sept. 1	E	S	11·86

B.J. 799
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 2	E	N	21 11 11·80
8	E	S	11·86
9	E	N	11·89
10	E	S	11·84
13	E	S	11·85
15	E	S	11·87
16	W	N	11·85
17	W	S	11·89
19	W	N	11·88
21	W	N	11·85
22	W	S	11·86
26	W	N	11·84
28	W	N	11·90
29	W	S	11·88r
30	W	N	11·87
Oct. 7	W	N	11·82
10	W	N	11·83r
11	W	S	11·87
12	E	N	11·84
19	E	N	11·85r
Mean			11·858
Δ_1			·003
Δ_2			·000
Mean R.A.			21 11 11·861

σ Cygni
Dec. 39° 01′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 11	W	S	21 13 52·74
31	E	N	52·78
Sept. 1	E	S	52·75
2	E	N	52·77
9	E	N	52·79
10	E	S	52·75
13	E	S	52·80
14	E	N	52·73
16	W	N	52·81
21	W	N	52·79
22	W	S	52·81
26	W	N	52·76
28	W	N	52·68
Oct. 7	W	N	52·74
18	E	S	52·71
Mean			52·761
Δ_1			–·002
Δ_2			·000
Mean R.A.			21 13 52·759

υ Cygni
Dec. 34° 31′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 20	E	S	21 14 12·96
Sept. 8	E	S	12·95
15	E	S	12·99
17	W	S	12·98
19	W	N	13·02
30	W	N	12·99
Oct. 10	W	N	12·95
12	E	N	12·95
17	E	N	12·96
19	E	N	12·92
26	E	N	12·89
Mean			12·960
Δ_2			·000
Mean R.A.			21 14 12·960

Bradley 2796
Dec. 76° 38′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 11	W	S	21 16 41·94
Sept. 1	E	S	41·84
13	E	S	41·77
21	W	N	41·86
29	W	S	41·95
Oct. 10	W	N	41·83
11	W	S	41·86
18	E	S	41·82
19	E	N	41·76
Mean			41·848
Δ_2			·000
Mean R.A.			21 16 41·848

B.J. 804
Dec. 19° 25′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 2	E	N	21 17 55·43
9	E	N	55·43
13	E	S	55·38
14	E	N	55·40
16	W	N	55·45
19	W	N	55·44
21	W	N	55·41
22	W	S	55·40
30	W	N	55·43

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 804 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 3	W	N	21 17 55·40
18	E	S	55·47
19	E	N	55·45
26	E	N	55·40
Mean			55·422
Δ_1			·004
Δ_2			−·001
Mean R.A.			21 17 55·425

69 Cygni
Dec. 36° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 20	E	S	21 22 06·27
31	E	N	06·27
Sept. 1	E	S	06·25
2	E	N	06·19
8	E	S	06·28
9	E	N	06·21
10	E	S	06·25
13	E	S	06·27
14	E	N	06·23
15	E	S	06·25
16	W	N	06·39
17	W	S	06·33
19	W	N	06·24r
21	W	N	06·33r
22	W	S	06·33r
28	W	N	06·24
29	W	S	06·27
30	W	N	06·30
Oct. 7	W	N	06·30r
10	W	N	06·34
11	W	S	06·31r
12	E	N	06·29r
18	E	S	06·28
19	E	N	06·26
20	E	S	06·23
26	E	N	06·25
Mean			06·275
Δ_2			·000
Mean R.A.			21 22 06·275

B.J. 807
Dec. 46° 09′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 20	E	S	21 26 07·61
Sept. 1	E	S	07·58
2	E	N	07·62
9	E	N	07·60
10	E	S	07·59
13	E	S	07·67
14	E	N	07·60
19	W	N	07·68
21	W	N	07·63
22	W	S	07·62
26	W	N	07·70
28	W	N	07·63
29	W	S	07·59
30	W	N	07·71
Oct. 7	W	N	07·61
10	W	N	07·59
11	W	S	07·65
17	E	N	07·63
19	E	N	07·66
26	E	N	07·64
Mean			07·631
Δ_1			·000
Δ_2			−·001
Mean R.A.			21 26 07·630

B.J. 809
Dec. 70° 10′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 27 30·15
Sept. 1	E	S	30·09
9	E	N	30·12
10	E	S	30·17
15	E	S	30·15
21	W	N	30·16
28	W	N	30·24
Oct. 10	W	N	30·21
17	E	N	30·21
26	E	N	30·11
Mean			30·161
Δ_1			−·001
Δ_2			·003
Mean R.A.			21 27 30·163

Groombridge 3511
Dec. 80° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 29	W	S	21 27 30·24
Oct. 18	E	S	30·12
20	E	S	30·27
Mean			30·210
Δ_2			·018
Mean R.A.			21 27 30·228

ρ Cygni
Dec. 45° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 30 35·59
Sept. 1	E	S	35·69
8	E	S	35·66
9	E	N	35·58
14	E	N	35·65
21	W	N	35·74
22	W	S	35·64
29	W	S	35·66
30	W	N	35·64
Oct. 7	W	N	35·57
18	E	S	35·67
26	E	N	35·63
Mean			35·643
Δ_2			·000
Mean R.A.			21 30 35·643

72 Cygni
Dec. 38° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 20	E	S	21 31 05·89
Sept. 10	E	S	05·90
13	E	S	05·92
16	W	N	05·93
17	W	S	05·95
19	W	N	05·91
26	W	N	05·87
Oct. 10	W	N	05·87
12	E	N	05·90
17	E	N	05·94
19	E	N	05·90
20	E	S	05·89
Mean			05·906
Δ_2			·000
Mean R.A.			21 31 05·906

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 811
Dec. 40° 01′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 31	E	N	21 33 20·44
Sept. 1	E	S	20·38
8	E	S	20·43
9	E	N	20·41
10	E	S	20·40
14	E	N	20·39
15	E	S	20·42
16	W	N	20·41
17	W	S	20·41
19	W	N	20·45
21	W	N	20·48
22	W	S	20·43
26	W	N	20·42
28	W	N	20·46
29	W	S	20·41
30	W	N	20·44
Oct. 7	W	N	20·40
10	W	N	20·39
11	W	S	20·41
12	E	N	20·38
17	E	N	20·36
18	E	S	20·43
19	E	N	20·41
20	E	S	20·43
26	E	N	20·42

Mean 20·416
Δ_1 −·004
Δ_2 ·000

Mean R.A. 21 33 20·412

B.J. 813
Dec. 57° 05′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 36 09·90
Sept. 1	E	S	10·03
8	E	S	09·94
9	E	N	09·84
10	E	S	10·05
14	E	N	09·95
15	E	S	10·07
16	W	N	10·10
17	W	S	10·03
19	W	N	09·98
21	W	N	10·04
22	W	S	10·06
26	W	N	10·02
28	W	N	10·04
29	W	S	09·97
30	W	N	10·04

B.J. 813
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 7	W	N	21 36 10·03
10	W	N	10·10
12	E	N	10·02
17	E	N	10·04
18	E	S	10·00
19	E	N	10·03
20	E	S	10·02
26	E	N	09·96

Mean 10·011
Δ_1 ·004
Δ_2 ·000

Mean R.A. 21 36 10·015

B.J. 816
Dec. 25° 14′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 8	E	S	21 40 34·14
16	W	N	34·20r
17	W	S	34·11r
19	W	N	34·10
22	W	S	34·15
28	W	N	34·09r
30	W	N	34·13r
Oct 7	W	N	34·08
26	E	N	34·11r

Mean 34·123
Δ_1 −·002
Δ_2 ·000

Mean R.A. 21 40 34·121

B.J. 817
Dec. 70° 54′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 40 36·34
Sept. 1	E	S	36·43
9	E	N	36·15
10	E	S	36·49r
13	E	S	36·27r
14	E	N	36·29
15	E	S	36·38r
21	W	N	36·39r
26	W	N	36·49
27	W	S	36·39r
29	W	S	36·31

B.J. 817
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 10	W	N	21 40 36·41r
11	W	S	36·36
12	E	N	36·28
17	E	N	36·39r
18	E	S	36·29
19	E	N	36·23
20	E	S	36·38

Mean 36·349
Δ_1 ·004
Δ_2 ·004

Mean R.A. 21 40 36·357

78 Draconis
Dec. 71° 54′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 41 58·57
Sept. 1	E	S	58·51r
9	E	N	58·53
10	E	S	58·64
13	E	S	58·69
14	E	N	58·47r
15	E	S	58·62
21	W	N	58·74
26	W	N	58·60r
27	W	S	58·63
29	W	S	58·46r
Oct. 10	W	N	58·61
11	W	S	58·60r
12	E	N	58·53r
17	E	N	58·53
18	E	S	58·57r
19	E	N	58·53r
20	E	S	58·57r

Mean 58·578
Δ_2 ·004

Mean R.A. 21 41 58·582

B.J. 821
Dec. 48° 54′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 43 28·01
Sept. 1	E	S	28·03
8	E	S	28·00
9	E	N	27·94

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 821 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 10	E	S	21 43 28·02
13	E	S	28·07
14	E	N	28·04
15	E	S	28·03
16	W	N	27·97
19	W	N	28·12
21	W	N	28·05
22	W	S	28·05
26	W	N	28·06
27	W	S	28·00
28	W	N	27·99
29	W	S	27·96
30	W	N	28·03
Oct. 7	W	N	28·01
10	W	N	27·99
11	W	S	27·99
12	E	N	28·03
17	E	N	28·03
18	E	S	27·96
19	E	N	28·00
26	E	N	28·00
Mean			28·015
Δ_1			−·002
Δ_2			·000
Mean R.A.			21 43 28·013

14 Pegasi, Dec. 29° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 45 51·78
Sept. 8	E	S	51·71
9	E	N	51·65
13	E	S	51·71
14	E	N	51·74
15	E	S	51·70
16	W	N	51·72
19	W	N	51·72
21	W	N	51·73
22	W	S	51·73
26	W	N	51·77
28	W	N	51·76
29	W	S	51·70
30	W	N	51·75
Oct. 7	W	N	51·72
10	W	N	51·74
11	W	S	51·71
12	E	N	51·65
17	E	N	51·73
18	E	S	51·70

14 Pegasi (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 19	E	N	21 45 51·72
20	E	S	51·70
26	E	N	51·65
Nov. 9	E	N	51·76
Mean			51·719
Δ_2			−·001
Mean R.A.			21 45 51·718

B.J. 823, Dec. 25° 30′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 48 57·93
Sept. 8	E	S	58·01r
13	E	S	57·94
14	E	N	57·98
15	E	S	57·98
16	W	N	58·01
19	W	N	57·97r
21	W	N	57·99
22	W	S	57·99r
26	W	N	57·93
28	W	N	58·00
29	W	S	57·97
30	W	N	58·00
Oct. 7	W	N	57·94r
10	W	N	58·02
11	W	S	57·94
12	E	N	57·89
17	E	N	57·92
18	E	S	57·96
19	E	N	57·94
20	E	S	57·90
Nov. 9	E	N	57·95
Mean			57·962
Δ_1			−·005
Δ_2			−·001
Mean R.A.			21 48 57·956

Bradley 2868, Dec. 55° 47′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 50 04·96
Sept. 1	E	S	04·95
8	E	S	04·97
10	E	S	05·05

Bradley 2868 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 13	E	S	21 50 05·07
14	E	N	04·97
15	E	S	05·01
16	W	N	04·97
19	W	N	05·04
21	W	N	05·02r
22	W	S	05·03
26	W	N	05·02
27	W	S	04·99
28	W	N	04·99r
29	W	S	04·98r
30	W	N	04·91
Oct. 7	W	N	05·03r
10	W	N	05·05
12	E	N	04·96
18	E	S	04·92
19	E	N	04·97
20	E	S	04·92
Nov. 9	E	N	05·06r
Mean			04·993
Δ_2			·000
Mean R.A.			21 50 04·993

79 Draconis, Dec. 73° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	21 51 44·19
Sept. 1	E	S	43·93
10	E	S	44·19
27	W	S	44·07
Oct. 11	W	S	44·13
17	E	N	44·02
18	E	S	44·05
20	E	S	44·07
Mean			44·081
Δ_1			·000
Δ_2			·011
Mean R.A.			21 51 44·092

13 Cephei, Dec. 56° 11′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 8	E	S	21 51 51·56
13	E	S	51·62
14	E	N	51·56r
15	E	S	51·53

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

13 Cephei (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 16	W	N	21 51 51·57
19	W	N	51·54r
21	W	N	51·59
22	W	S	51·57r
26	W	N	51·55r
28	W	N	51·60
29	W	S	51·49
30	W	N	51·53r
Oct. 7	W	N	51·62
10	W	N	51·50r
12	E	N	51·49r
19	E	N	51·54r
21	E	S	51·57
Nov. 9	E	N	51·51

Mean 51·552
Δ_2 −·002

Mean R.A. 21 51 51·550

B.J. 826
Dec. 12° 41′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 8	E	S	21 56 42·24
13	E	S	42·21
14	E	N	42·26
15	E	S	42·19
16	W	N	42·24
19	W	N	42·28
21	W	N	42·24
22	W	S	42·21
26	W	N	42·24
30	W	N	42·29
Oct. 7	W	N	42·23
11	W	S	42·27
18	E	S	42·29

Mean 42·245
Δ_1 ·002
Δ_2 ·000

Mean R.A. 21 56 42·247

Bradley 2897
Dec. 74° 34′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 31	E	N	21 56 59·88
Sept. 1	E	S	59·74r
10	E	S	59·95
27	W	S	59·80r
28	W	N	59·96r
29	W	S	59·74
Oct. 10	W	N	59·75
12	E	N	59·68
17	E	N	59·79r
19	E	N	59·61
20	E	S	59·78
21	E	S	59·78r
Nov. 9	E	N	59·78

Mean 59·788
Δ_2 ·006

Mean R.A. 21 56 59·794

16 Cephei
Dec. 72° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 13	E	S	21 57 58·06
14	E	N	57·96
15	E	S	58·03r
26	W	N	58·06
27	W	S	57·98
28	W	N	58·12
29	W	S	57·90r
Oct. 10	W	N	57·98r
11	W	S	58·03
12	E	N	58·00
17	E	N	57·87
18	E	S	57·96
19	E	N	57·95r
20	E	S	57·95r
21	E	S	57·98
Nov. 9	E	N	58·06r

Mean 57·993
Δ_2 ·004

Mean R.A. 21 57 57·997

B.J. 831
Dec. 24° 54′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Aug. 31	E	N	22 02 49·23
Sept. 13	E	S	49·21
14	E	N	49·19
15	E	S	49·23
16	W	N	49·26
19	W	N	49·17
21	W	N	49·20
22	W	S	49·19
26	W	N	49·18
28	W	N	49·22
29	W	S	49·22
30	W	N	49·17
Oct. 3	W	N	49·22
7	W	N	49·15
10	W	N	49·26
11	W	S	49·17
12	E	N	49·17
17	E	N	49·22
18	E	S	49·23
19	E	N	49·15
20	E	S	49·20
21	E	S	49·19
26	E	N	49·23

Mean 49·203
Δ_1 ·003
Δ_2 −·001

Mean R.A. 22 02 49·205

B.J. 833
Dec. 32° 44′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	22 05 14·23
Sept. 10	E	S	14·29r
13	E	S	14·28r
14	E	N	14·28r
15	E	S	14·25
16	W	N	14·19r
19	W	N	14·25
21	W	N	14·22r
22	W	S	14·26
26	W	N	14·28
27	W	S	14·28r
28	W	N	14·23r
29	W	S	14·29
30	W	N	14·29

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 833 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 3	W	N	22 05 14·21r
7	W	N	14·36r
10	W	N	14·32
11	W	S	14·23
12	E	N	14·28
17	E	N	14·24r
18	E	S	14·25
19	E	N	14·28
20	E	S	14·25
21	E	S	14·27r
26	E	N	14·25r
Nov. 9	E	N	14·27r

Mean 14·263
Δ_1 −·003
Δ_2 −·001

Mean R.A. 22 05 14·259

B.J. 835
Dec. 32° 44′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	22 05 59·35
Sept. 10	E	S	59·30
14	E	N	59·31
16	W	N	59·38
19	W	N	59·35r
21	W	N	59·28
22	W	S	59·43r
26	W	N	59·33r
27	W	S	59·27
28	W	N	59·32
30	W	N	59·33r
Oct. 3	W	N	59·29
7	W	N	59·37
10	W	N	59·32r
12	E	N	59·42r
17	E	N	59·33
19	E	N	59·35r
20	E	S	59·30r
26	E	N	59·34
Nov. 9	E	N	59·23

Mean 59·330
Δ_1 ·004
Δ_2 −·001

Mean R.A. 22 05 59·333

28 Pegasi
Dec. 20° 32′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 13	E	S	22 06 14·87
15	E	S	14·85
29	W	S	14·88
Oct. 11	W	S	14·90
18	E	S	14·88
21	E	S	14·91

Mean 14·882
Δ_2 ·002

Mean R.A. 22 06 14·884

B.J. 836
Dec. 57° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	22 07 43·78
Sept. 16	W	N	43·88
19	W	N	43·81
22	W	S	43·82
26	W	N	43·79
30	W	N	43·84
Oct. 3	W	N	43·85
7	W	N	43·81
10	W	N	43·76
26	E	N	43·81
Nov. 2	E	N	43·88

Mean 43·821
Δ_1 −·003
Δ_2 −·005

Mean R.A. 22 07 43·813

B.J. 837
Dec. 71° 54′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 10	E	S	22 08 04·86
13	E	S	04·83
14	E	N	04·88
15	E	S	04·79
27	W	S	04·57
28	W	N	04·87
29	W	S	04·74
Oct. 11	W	S	04·83
12	E	N	04·76
17	E	N	04·81

B.J. 837 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 18	E	S	22 08 04·77
19	E	N	04·71
20	E	S	04·70
21	E	S	04·88
Nov. 9	E	N	04·74

Mean 04·783
Δ_1 −·005
Δ_2 ·007

Mean R.A. 22 08 04·785

1 H.Lacertae
Dec. 39° 16′

Date	Clamp	Observer	Mean R.A. 1910·0
Aug. 31	E	N	22 10 00·87
Sept. 10	E	S	00·86
13	E	S	00·84
14	E	N	00·79
15	E	S	00·78
16	W	N	00·82
19	W	N	00·75
21	W	N	00·82
22	W	S	00·88
26	W	N	00·80
27	W	S	00·84
28	W	N	00·98
29	W	S	00·84
30	W	N	00·80
Oct. 3	W	N	00·78
7	W	N	00·75
10	W	N	00·82
12	E	N	00·76
17	E	N	00·79
18	E	S	00·81
19	E	N	00·79
20	E	S	00·78
21	E	S	00·82
26	E	N	00·81
Nov. 2	E	N	00·85
9	E	N	00·81

Mean 00·816
Δ_2 ·000

Mean R.A. 22 10 00·816

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

Bradley 2942
Dec. 72° 52′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 10	E	S	22 11 15·22
13	E	S	15·23
14	E	N	15·12
15	E	S	15·10
21	W	N	15·07
26	W	N	15·13
27	W	S	15·10
29	W	S	15·06
Oct. 10	W	N	15·03
11	W	S	14·95
12	E	N	15·13
18	E	S	15·02
19	E	N	15·03
20	E	S	15·07
21	E	S	15·08
Nov. 2	E	N	15·24

Mean 15·099
Δ_2 ·004

Mean R.A. 22 11 15·103

B.J. 844
Dec. 51° 47′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 30	W	N	22 20 01·140

Δ_1 ·002
Δ_2 −·007

Mean R.A. 22 20 01·135

B.D. 70·1240
Dec. 70° 19′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 10	E	S	22 23 41·22
13	E	S	41·14
15	E	S	41·07
21	W	N	40·98
27	W	S	40·89
28	W	N	41·10
29	W	S	41·08

B.D. 70·1240
(continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 10	W	N	22 23 41·05
12	E	N	41·21
17	E	N	41·05
18	E	S	41·04
19	E	N	40·95
21	E	S	41·10
Nov. 2	E	N	41·16
9	E	N	40·94

Mean 41·065
Δ_2 ·004

Mean R.A. 22 23 41·069

B.J. 847
Dec. 57° 57′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 21	W	N	22 25 49·47
28	W	N	49·53
30	W	N	49·59
Oct. 3	W	N	49·60
7	W	N	49·53
10	W	N	49·57
17	E	N	49·64
19	E	N	49·53
26	E	N	49·61
Nov. 2	E	N	49·68
9	E	N	49·55

Mean 49·573
Δ_1 ·003
Δ_2 −·004

Mean R.A. 22 25 49·572

38 Pegasi
Dec. 32° 07′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 22	W	S	22 25 54·70
Oct. 18	E	S	54·69
21	E	S	54·74
Nov. 20	W	S	54·70

Mean 54·708
Δ_2 ·002

Mean R.A. 22 25 54·710

28 Cephei
Dec. 78° 20′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 10	E	S	22 26 02·42r
13	E	S	02·44
15	E	S	02·35
27	W	S	02·23r
29	W	S	02·15
Oct. 12	E	N	01·87

Mean 02·243
Δ_2 ·013

Mean R.A. 22 26 02·256

B.J. 848
Dec. 49° 49′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 10	E	S	22 27 34·89
13	E	S	34·89
15	E	S	34·81
21	W	N	34·79
22	W	S	34·86
27	W	S	34·86
28	W	N	34·88
29	W	S	34·80
30	W	N	34·86
Oct. 3	W	N	34·85
7	W	N	34·72
10	W	N	34·79
12	E	N	34·86
17	E	N	34·85
18	E	S	34·83
19	E	N	34·80
21	E	S	34·80
26	E	N	34·86
Nov. 2	E	N	34·89
9	E	N	34·85
20	W	S	34·87

Mean 34·839
Δ_1 −·002
Δ_2 ·000

Mean R.A. 22 27 34·837

29 Cephei
Dec. 78° 22′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 10	E	S	22 29 05·67
13	E	S	05·62r
15	E	S	05·53r
21	W	N	05·45

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

Date	Clamp	Observer	Mean R.A. 1910·0
29 Cephei (continued)			
			h m s
Sept. 27	W	S	22 29 05·52
28	W	N	05·54
29	W	S	05·47r
Oct. 10	W	N	05·41
12	E	N	05·53r
17	E	N	05·38
18	E	S	05·45
19	E	N	05·34
Nov. 2	E	N	05·80
20	W	S	05·51
Mean			05·516
Δ_2			·003
Mean R.A.			22 29 05·519
226 B.Cephei Dec. 75° 46′			
Sept. 10	E	S	22 30 41·85
27	W	S	41·60
28	W	N	41·85
Oct. 10	W	N	41·51
17	E	N	41·58
18	E	S	41·53
19	E	N	41·67
21	E	S	41·67
Nov. 2	E	N	41·78
9	E	N	41·58
20	W	S	41·63
Mean			41·659
Δ_1			·004
Δ_2			·004
Mean R.A.			22 30 41·667
B.J. 851 Dec. 73° 11′			
Sept. 10	E	S	22 33 32·86
13	E	S	32·88
15	E	S	32·78
21	W	N	32·61
27	W	S	32·68
28	W	N	32·87
29	W	S	32·71
B.J. 851 (continued)			
			h m s
Oct. 10	W	N	22 33 32·63
12	E	N	32·70
17	E	N	32·60
18	E	S	32·72
19	E	N	32·43
Nov. 2	E	N	32·76
8	E	S	32·67
9	E	N	32·73
20	W	S	32·65
Mean			32·705
Δ_1			−·005
Δ_2			·004
Mean R.A.			22 33 32·704
B.J. 852 Dec. 38° 35′			
Sept. 21	W	N	22 35 13·13
28	W	N	13·22
30	W	N	13·23
Oct. 3	W	N	13·22
7	W	N	13·22
10	W	N	13·23
12	E	N	13·16
17	E	N	13·24
19	E	N	13·16
26	E	N	13·27
Nov. 2	E	N	13·30
9	E	N	13·26
Mean			13·220
Δ_1			·003
Δ_2			−·002
Mean R.A.			22 35 13·221
Groombridge 3857 Dec. 74° 54′			
Sept. 10	E	S	22 35 17·46
13	E	S	17·33
15	E	S	17·26
27	W	S	17·22
29	W	S	17·28
Oct. 18	E	S	17·12
21	E	S	17·23
Nov. 20	W	S	17·21
Groombridge 3857 (continued)			
			h m s
Mean			22 35 17·264
Δ_2			·010
Mean R.A.			22 35 17·274
B.J. 853 Dec. 63° 07′			
Nov. 8	E	S	22 35 27·100
Δ_1			−·005
Δ_2			·012
Mean R.A.			22 35 27·107
B.J. 855 Dec. 10° 22′			
Sept. 13	E	S	22 36 58·39
15	E	S	58·33
21	W	N	58·41
28	W	N	58·35r
30	W	N	58·41
Oct. 7	W	N	58·42
10	W	N	58·42r
12	E	N	58·39
17	E	N	58·39r
18	E	S	58·38
19	E	N	58·39
21	E	S	58·35r
26	E	N	58·41r
Nov. 2	E	N	58·43
8	E	S	58·36
9	E	N	58·36r
20	W	S	58·45r
Mean			58·391
Δ_1			−·004
Δ_2			−·001
Mean R.A.			22 36 58·386

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 857
Dec. 29° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 13	E	S	22 38 46·88
15	E	S	46·88
21	W	N	46·89
28	W	N	46·86
30	W	N	46·83
Oct. 3	W	N	46·84
7	W	N	46·89
10	W	N	46·92
17	E	N	46·90
18	E	S	46·90
19	E	N	46·89
Nov. 2	E	N	46·97
8	E	S	46·88
9	E	N	46·93
20	W	S	46·91

Mean 46·891
Δ_1 −·003
Δ_2 ·000

Mean R.A. 22 38 46·888

B.J. 858
Dec. 41° 21′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 10	E	S	22 40 04·58r
15	E	S	04·46
21	W	N	04·45
27	W	S	04·48r
28	W	N	04·50r
30	W	N	04·53
Oct. 3	W	N	04·63
7	W	N	04·38
10	W	N	04·46r
12	E	N	04·49
17	E	N	04·46r
18	E	S	04·45
19	E	N	04·45
21	E	S	04·48r
Nov. 2	E	N	04·46
8	E	S	04·48r
9	E	N	04·45r
20	W	S	04·48

Mean 04·482
Δ_1 −·002
Δ_2 −·001

Mean R.A. 22 40 04·479

B.J. 859
Dec. 23° 06′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 15	E	S	22 42 11·69
21	W	N	11·69r
28	W	N	11·73r
30	W	N	11·70
Oct. 3	W	N	11·75
7	W	N	11·68
10	W	N	11·68r
12	E	N	11·69
17	E	N	11·73r
18	E	S	11·65r
19	E	N	11·69
21	E	S	11·70r
Nov. 2	E	N	11·73
8	E	S	11·66
9	E	N	11·73
20	W	S	11·67

Mean 11·698
Δ_1 ·001
Δ_2 −·001

Mean R.A. 22 42 11·698

B.J. 862
Dec. 24° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 15	E	S	22 45 39·46r
21	W	N	39·46
28	W	N	39·48
30	W	N	39·43r
Oct. 3	W	N	39·43
7	W	N	39·46r
10	W	N	39·46
17	E	N	39·48
18	E	S	39·46
19	E	N	39·52r
21	E	S	39·48
Nov. 2	E	N	39·45r
9	E	N	39·49

Mean 39·466
Δ_1 −·002
Δ_2 −·001

Mean R.A. 22 45 39·463

B.J. 863
Dec. 65° 44′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Nov. 8	E	S	22 46 28·34
20	W	S	28·35

Mean 28·345
Δ_1 −·005
Δ_2 ·004

Mean R.A. 22 46 28·344

52 Pegasi
Dec. 11° 15′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 15	E	S	22 54 41·64
21	W	N	41·61r
22	W	S	41·64
28	W	N	41·59
29	W	S	41·63
Oct. 7	W	N	41·67r
10	W	N	41·65
17	E	N	41·64
18	E	S	41·58r
19	E	N	41·65r
20	E	S	41·63
21	E	S	41·60
Nov. 8	E	S	41·58r
9	E	N	41·64
20	W	S	41·60

Mean 41·623
Δ_2 ·000

Mean R.A. 22 54 41·623

B.J. 869
Dec. 41° 51′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 10	E	S	22 57 46·63
15	E	S	46·65r
21	W	N	46·54r
22	W	S	46·65
27	W	S	46·56
28	W	N	46·62
29	W	S	46·60r

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 869 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 3	W	N	22 57 46·68
7	W	N	46·65r
10	W	N	46·64
17	E	N	46·53
18	E	S	46·62r
19	E	N	46·61r
20	E	S	46·61
21	E	S	46·63
Nov. 2	E	N	46·63r
8	E	S	46·57
9	E	N	46·54
20	W	S	46·59r

Mean 46·608
Δ_1 ·003
Δ_2 ·000

Mean R.A. 22 57 46·611

B.J. 870
Dec. 27° 36′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 15	E	S	22 59 24·60
21	W	N	24·53
28	W	N	24·65
29	W	S	24·56
Oct. 3	W	N	24·58
7	W	N	24·64
10	W	N	24·61
17	E	N	24·54
19	E	N	24·60
21	E	S	24·58
Nov. 2	E	N	24·60
9	E	N	24·54

Mean 24·586
Δ_1 −·005
Δ_2 −·001

Mean R.A. 22 59 24·580

B.J. 871
Dec. 14° 43′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 21	W	N	23 00 16·60
22	W	S	16·60
29	W	S	16·58
Oct. 7	W	N	16·62

B.J. 871 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 18	E	S	23 00 16·60
20	E	S	16·63
Nov. 2	E	N	16·64
8	E	S	16·62
9	E	N	16·66
20	W	S	16·56

Mean 16·611
Δ_1 ·000
Δ_2 ·000

Mean R.A. 23 00 16·611

5 Andromedae
Dec. 48° 48′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 10	E	S	23 03 40·01
15	E	S	39·91
21	W	N	39·91
27	W	S	39·92
29	W	S	39·92
Oct. 7	W	N	39·85
17	E	N	39·88
18	E	S	39·85
20	E	S	39·90
21	E	S	39·87
Nov. 2	E	N	39·90
4	E	N	39·83
9	E	N	39·86
20	W	S	39·87

Mean 39·891
Δ_2 ·001

Mean R.A. 23 03 39·892

B.J. 874
Dec. 74° 54′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 10	E	S	23 05 02·13r
15	E	S	01·94
21	W	N	01·82
27	W	S	01·92
29	W	S	01·83r
Oct. 10	W	N	01·74r
17	E	N	01·88

B.J. 874 (continued)

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Oct. 18	E	S	23 05 01·81
20	E	S	01·92
21	E	S	01·93r
Nov. 2	E	N	01·79
4	E	N	01·67
8	E	S	01·88r
9	E	N	01·87r
20	W	S	01·86r

Mean 01·866
Δ_1 −·005
Δ_2 ·007

Mean R.A. 23 05 01·868

B.J. 875
Dec. 56° 40′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 10	E	S	23 08 56·67
15	E	S	56·65
21	W	N	56·58
27	W	S	56·69
29	W	S	56·62
Oct. 3	W	N	56·68
7	W	N	56·68
10	W	N	56·61
17	E	N	56·54
18	E	S	56·59
19	E	N	56·60
20	E	S	56·64
21	E	S	56·55
Nov. 2	E	N	56·62
4	E	N	56·53
8	E	S	56·58
9	E	N	56·55
20	W	S	56·64

Mean 56·612
Δ_1 −·003
Δ_2 ·002

Mean R.A. 23 08 56·611

Bradley 3085
Dec. 73° 44′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 10	E	S	23 11 24·93
21	W	N	24·75
27	W	S	24·83

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

Date	Clamp	Observer	Mean R.A. 1910·0
Bradley 3085 (continued)			
			h m s
Sept. 29	W	S	23 11 24·90
Oct. 17	E	N	24·82
18	E	S	24·78
20	E	S	24·89
21	E	S	24·78
Nov. 2	E	N	24·68
8	E	S	24·77
9	E	N	24·80
20	W	S	24·90
Mean			24·819
Δ_2			·007
Mean R.A.			23 11 24·826
Bradley 3086 Dec. 70° 24′			
Oct. 17	E	N	23 12 09·08
Nov. 4	E	N	08·89
9	E	N	09·10
Mean			09·023
Δ_2			·007
Mean R.A.			23 12 09·030
Groombridge 4033 Dec. 74° 48′			
Sept. 10	E	S	23 14 08·44
21	W	N	08·23
27	W	S	08·39r
Oct. 10	W	N	08·26
17	E	N	08·28
18	E	S	08·28r
20	E	S	08·27r
21	E	S	08·22
Nov. 2	E	N	08·17r
9	E	N	08·29
20	W	S	08·26
27	W	S	08·38
Mean			08·289
Δ_2			·004
Mean R.A.			23 14 08·293

Date	Clamp	Observer	Mean R.A. 1910·0
***o* Cephei Dec. 67° 37′**			
			h m s
Nov. 4	E	N	23 14 55·22
8	E	S	55·28
Mean			55·250
Δ_1			·003
Δ_2			·010
Mean R.A.			23 14 55·263
B.J. 880 Dec. 23° 15′			
Sept. 21	W	N	23 16 10·87
29	W	S	10·79
Oct. 3	W	N	10·82
10	W	N	10·90r
17	E	N	10·80r
18	E	S	10·83
20	E	S	10·87
21	E	S	10·83r
Nov. 2	E	N	10·81
4	E	N	10·83
8	E	S	10·83r
9	E	N	10·85r
20	W	S	10·84r
27	W	S	10·83
Mean			10·836
Δ_1			−·002
Δ_2			·000
Mean R.A.			23 16 10·834
B.J. 882 Dec. 61° 47′			
Nov. 20	W	S	23 20 50·18
27	W	S	50·07
Mean			50·125
Δ_1			−·004
Δ_2			−·004
Mean R.A.			23 20 50·117

Date	Clamp	Observer	Mean R.A. 1910·0
B.J. 881 Dec. 22° 55′			
			h m s
Sept. 21	W	N	23 20 53·14
29	W	S	53·14r
Oct. 3	W	N	53·13
7	W	N	53·21
10	W	N	53·17
17	E	N	53·14
18	E	S	53·15r
20	E	S	53·17
21	E	S	53·13
Nov. 2	E	N	53·08r
4	E	N	53·13r
8	E	S	53·13
9	E	N	53·11
Mean			53·141
Δ_1			−·001
Δ_2			·000
Mean R.A.			23 20 53·140
B.J. 885 Dec. 12° 16′			
Sept. 29	W	S	23 24 36·12
Oct. 7	W	N	36·18
17	E	N	36·13
18	E	S	36·13
20	E	S	36·10
21	E	S	36·12
Nov. 2	E	N	36·12
4	E	N	36·10
8	E	S	36·13
9	E	N	36·13
20	W	S	36·15
27	W	S	36·18
Mean			36·132
Δ_1			−·005
Δ_2			·000
Mean R.A.			23 24 36·127

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

1 H.Cassiopeiae
Dec. 58° 03′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 10	E	S	23 25 52·36
Oct. 21	E	S	52·16
Nov. 27	W	S	52·29

Mean 52·270
Δ_2 ·005

Mean R.A. 23 25 52·275

15 Andromedae
Dec. 39° 44′

Date	Clamp	Observer	Mean R.A. 1910·0
Oct. 21	E	S	23 30 13·12
Nov. 9	E	N	13·11
27	W	S	13·19

Mean 13·140
Δ_2 ·001

Mean R.A. 23 30 13·141

Bradley 3140
Dec. 71° 09′

Date	Clamp	Observer	Mean R.A. 1910·0
Oct. 17	E	N	23 31 04·18
20	E	S	04·33
Nov. 2	E	N	04·18
4	E	N	04·03

Mean 04·180
Δ_2 ·011

Mean R.A. 23 31 04·191

B.J. 890
Dec. 45° 58′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 29	W	S	23 33 09·27
Oct. 3	W	N	09·24
17	E	N	09·25
18	E	S	09·26
20	E	S	09·24r
21	E	S	09·25
Nov. 2	E	N	09·22
4	E	N	09·20
8	E	S	09·26r
9	E	N	09·28
20	W	S	09·30r
27	W	S	09·33

Mean 09·258
Δ_1 ·004
Δ_2 ·001

Mean R.A. 23 33 09·263

B.J. 891
Dec. 42° 46′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	23 33 43·06
Nov. 4	E	N	43·02
9	E	N	43·16

Mean 43·080
Δ_1 −·002
Δ_2 ·001

Mean R.A. 23 33 43·079

Groombridge 4119
Dec. 74° 48′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 29	W	S	23 35 18·03
Oct. 17	E	N	17·92
18	E	S	17·97
20	E	S	18·08
Nov. 8	E	S	17·94

Mean 17·988
Δ_2 ·014

Mean R.A. 23 35 18·002

B.J. 893
Dec. 77° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Nov. 4	E	N	23 35 38·270

Δ_1 −·002
Δ_2 ·013

Mean R.A. 23 35 38·281

κ Andromedae
Dec. 43° 50′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	23 35 58·22
Oct. 21	E	S	58·26
Nov. 2	E	N	58·22
9	E	N	58·22
20	W	S	58·26

Mean 58·236
Δ_1 −·005
Δ_2 ·002

Mean R.A. 23 35 58·233

ψ Andromedae
Dec. 45° 55′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	23 41 34·13
29	W	S	34·15
Oct. 17	E	N	34·06
18	E	S	34·17r
20	E	S	34·16
21	E	S	34·14r
Nov. 2	E	N	34·14
4	E	N	34·12r
9	E	N	34·25r
20	W	S	34·20
27	W	S	34·14r

Mean 34·151
Δ_1 ·004
Δ_2 ·002

Mean R.A. 23 41 34·157

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 895
Dec. 67° 18′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Nov. 4	E	N	23 43 35·87r
8	E	S	35·94
9	E	N	35·91
20	W	S	35·99
27	W	S	35·96
Dec. 10	W	S	35·95

Mean 35·937
Δ_1 −·005
Δ_2 ·001

Mean R.A. 23 43 35·933

B.J. 898
Dec. 18° 37′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	23 47 54·42
Oct. 17	E	N	54·50
Nov. 4	E	N	54·50
8	E	S	54·42

Mean 54·460
Δ_1 −·001
Δ_2 −·001

Mean R.A. 23 47 54·458

Groombridge 4154
Dec. 75° 03′

Date	Clamp	Observer	Mean R.A. 1910·0
Oct. 18	E	S	23 48 00·59
20	E	S	00·67
21	E	S	00·54
Nov. 2	E	N	00·53
9	E	N	00·61
20	W	S	00·62
27	W	S	00·66

Mean 00·603
Δ_2 ·010

Mean R.A. 23 48 00·613

B.J. 899
Dec. 57° 00′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 7	E	S	23 49 52·82
Oct. 17	E	N	52·75
Nov. 4	E	N	52·74
8	E	S	52·80

Mean 52·778
Δ_1 ·002
Δ_2 ·006

Mean R.A. 23 49 52·786

Groombridge 4163
Dec. 73° 55′

Date	Clamp	Observer	Mean R.A. 1910·0
Oct. 18	E	S	23 50 26·29
20	E	S	26·25
21	E	S	26·23
Nov. 2	E	N	26·24
9	E	N	26·34
20	W	S	26·35
27	W	S	26·33r
Dec. 10	W	S	26·49r

Mean 26·315
Δ_1 −·005
Δ_2 ·007

Mean R.A. 23 50 26·317

ψ Pegasi
Dec. 24° 38′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	23 53 10·20
Oct. 17	E	N	10·15
18	E	S	10·18
20	E	S	10·23
21	E	S	10·23
Nov. 2	E	N	10·19
4	E	N	10·24
8	E	S	10·23
9	E	N	10·25
20	W	S	10·21
27	W	S	10·22
Dec. 10	W	S	10·23

Mean 10·213
Δ_2 ·001

Mean R.A. 23 53 10·214

B.J. 1
Dec. 28° 36′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Nov. 2	E	N	0 03 43·96
4	E	N	43·96
9	E	N	43·91
Dec. 10	W	S	43·97

Mean 43·950
Δ_1 −·002
Δ_2 −·001

Mean R.A. 0 03 43·947

Bradley 3217
Dec. 79° 13′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 27	W	S	0 04 20·91
Oct. 18	E	S	20·81
20	E	S	20·80
21	E	S	20·81
Nov. 8	E	S	20·78
20	W	S	20·65
27	W	S	20·84

Mean 20·800
Δ_2 ·013

Mean R.A. 0 04 20·813

B.J. 2
Dec. 58° 39′

Date	Clamp	Observer	Mean R.A. 1910·0
Nov. 2	E	N	0 04 21·98
9	E	N	22·10

Mean 22·040
Δ_1 ·004
Δ_2 ·003

Mean R.A. 0 04 22·047

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 4
Dec. 45° 34′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 27	W	S	0 05 38·31
Oct. 20	E	S	38·29
21	E	S	38·26
Nov. 2	E	N	38·18
9	E	N	38·28
27	W	S	38·25
Dec. 10	W	S	38·31
Mean			38·269
Δ_1			·002
Δ_2			·001
Mean R.A.			0 05 38·272

B.J. 7
Dec. 14° 41′

Date	Clamp	Observer	Mean R.A. 1910·0
Oct. 18	E	S	0 08 35·91
20	E	S	35·98
21	E	S	35·98
Nov. 2	E	N	35·93
4	E	N	36·03
8	E	S	35·94
9	E	N	35·97
20	W	S	35·97
27	W	S	35·98
Dec. 5	W	N	35·93
Mean			35·962
Δ_1			·003
Δ_2			·000
Mean R.A.			0 08 35·965

B.J. 8
Dec. 76° 27′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 27	W	S	0 11 06·39
Oct. 18	E	S	06·38
20	E	S	06·45
21	E	S	06·45
Nov. 2	E	N	06·36
8	E	S	06·43
9	E	N	06·57
27	W	S	06·48
Dec. 10	W	S	06·70

B.J. 8
(continued)

			h m s
Mean			0 11 06·468
Δ_1			·002
Δ_2			·010
Mean R.A.			0 11 06·480

σ Andromedae
Dec. 36° 17′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 27	W	S	0 13 37·31
Oct. 18	E	S	37·24r
20	E	S	37·29
21	E	S	37·32r
Nov. 4	E	N	37·25
8	E	S	37·23
9	E	N	37·37r
20	W	S	37·29r
27	W	S	37·34r
Dec. 10	W	S	37·30
Mean			37·294
Δ_1			·000
Δ_2			·001
Mean R.A.			0 13 37·295

ρ Andromedae
Dec. 37° 28′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 27	W	S	0 16 22·65r
Oct. 18	E	S	22·52
20	E	S	22·64r
21	E	S	22·57
Nov. 4	E	N	22·54r
8	E	S	22·59r
9	E	N	22·60
20	W	S	22·60
27	W	S	22·59
Dec. 10	W	S	22·60r
Mean			22·590
Δ_2			·002
Mean R.A.			0 16 22·592

Bradley 34
Dec. 76° 31′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 27	W	S	0 25 07·23
Oct. 18	E	S	07·02
20	E	S	07·16
21	E	S	07·17
Nov. 2	E	N	06·99
8	E	S	07·12
9	E	N	07·13
27	W	S	07·22
Dec. 5	W	N	07·49
10	W	S	07·40
Mean			07·193
Δ_2			·007
Mean R.A.			0 25 07·200

B.J. 16
Dec. 62° 26′

Date	Clamp	Observer	Mean R.A. 1910·0
Nov. 8	E	S	0 27 52·45
9	E	N	52·51r
27	W	S	52·47r
Dec. 5	W	N	52·58
9	W	N	52·58
Mean			52·518
Δ_1			·004
Δ_2			−·002
Mean R.A.			0 27 52·520

B.J. 17
Dec. 53° 24′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 27	W	S	0 31 57·00
Oct. 18	E	S	56·93
20	E	S	57·00
21	E	S	56·92
Nov. 8	E	S	57·00
9	E	N	56·96
27	W	S	56·97
Dec. 8	W	S	57·02
9	W	N	57·07
10	W	S	57·06
Mean			56·993
Δ_1			−·001
Δ_2			·002
Mean R.A.			0 31 56·994

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 18
Dec. 33° 13′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 7	E	S	0 32 04·18
Nov. 2	E	N	04·18
Dec. 5	W	N	04·15
Mean			04·170
Δ_1			·004
Δ_2			·000
Mean R.A.			0 32 04·174

B.J. 19
Dec. 28° 49′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	0 33 47·76
Oct. 21	E	S	47·78
Nov. 2	E	N	47·74
8	E	S	47·75
9	E	N	47·80
Dec. 5	W	N	47·84
9	W	N	47·74
Mean			47·773
Δ_1			−·004
Δ_2			·000
Mean R.A.			0 33 47·769

B.J. 20
Dec. 30° 22′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 27	W	S	0 34 30·76
Oct. 20	E	S	30·71
Nov. 2	E	N	30·70
9	E	N	30·71
27	W	S	30·68
Dec. 5	W	N	30·59
10	W	S	30·73
Mean			30·697
Δ_1			−·003
Δ_2			·000
Mean R.A.			0 34 30·694

B.J. 21
Dec. 56° 03′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 7	E	S	0 35 23·48
27	W	S	23·62
Oct. 18	E	S	23·45
20	E	S	23·41
21	E	S	23·57r
Nov. 2	E	N	23·51
8	E	S	23·53
9	E	N	23·58
Dec. 9	W	N	23·41
Mean			23·507
Δ_1			−·002
Δ_2			·003
Mean R.A.			0 35 23·508

B.J. 24
Dec. 74° 30′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 27	W	S	0 39 41·31
Oct. 18	E	S	41·06
20	E	S	41·25
Nov. 2	E	N	41·20
8	E	S	41·07r
9	E	N	41·16r
Dec. 5	W	N	41·46
8	W	S	41·21
Mean			41·215
Δ_1			−·002
Δ_2			·006
Mean R.A.			0 39 41·219

B.J. 25
Dec. 47° 48′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	0 39 42·18
Oct. 21	E	S	42·19
Nov. 27	W	S	42·20
Dec. 9	W	N	42·35
10	W	S	42·24
Mean			42·232
Δ_1			·004
Δ_2			·001
Mean R.A.			0 39 42·237

23 Cassiopeiae
Dec. 74° 21′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 27	W	S	0 41 44·32
Oct. 18	E	S	44·27r
21	E	S	44·26
Nov. 2	E	N	44·24r
8	E	S	44·30
9	E	N	44·39
Dec. 5	W	N	44·46
Mean			44·320
Δ_2			·008
Mean R.A.			0 41 44·328

B.D. 71·37
Dec. 72° 11′

Date	Clamp	Observer	Mean R.A. 1910·0
Oct. 20	E	S	0 42 15·24
Nov. 27	W	S	15·53
Dec. 9	W	N	15·64
10	W	S	15·43
Mean			15·460
Δ_2			−·004
Mean R.A.			0 42 15·456

B.J. 27
Dec. 23° 47′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	0 42 33·88
Nov. 9	E	N	33·99
Dec. 12	W	N	33·89
Mean			33·920
Δ_1			·000
Δ_2			−·001
Mean R.A.			0 42 33·919

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

η Cassiopeiae
Dec. 57° 20′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 7	E	S	0 43 39·03
27	W	S	39·08
Oct. 20	E	S	39·12r
21	E	S	39·07
Nov. 2	E	N	39·06
8	E	S	39·08r
9	E	N	39·11
27	W	S	39·12
Dec. 5	W	N	39·13
9	W	N	39·08
12	W	N	39·16
Mean			39·095
Δ_1			·003
Δ_2			·000
Mean R.A.			0 43 39·098

ν Andromedae
Dec. 40° 35′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	0 44 50·66
27	W	S	50·76
Oct. 18	E	S	50·69
20	E	S	50·72
21	E	S	50·73
Nov. 2	E	N	50·75
9	E	N	50·75
27	W	S	50·67
Dec. 5	W	N	50·66
9	W	N	50·66
10	W	S	50·68
12	W	N	50·73
Mean			50·705
Δ_1			·000
Δ_2			·000
Mean R.A.			0 44 50·705

B.J. 29
Dec. 63° 45′

Date	Clamp	Observer	Mean R.A. 1910·0
Nov. 8	E	S	0 45 15·230r
Δ_1			−·004
Δ_2			·012
Mean R.A.			0 45 15·238

B.J. 32
Dec. 60° 14′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Nov. 8	E	S	0 51 16·05
27	W	S	16·00
Dec. 9	W	N	16·09
Mean			16·047
Δ_1			−·005
Δ_2			−·002
Mean R.A.			0 51 16·040

B.J. 33
Dec. 38° 01′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	0 51 45·16
27	W	S	45·23
Oct. 18	E	S	45·13
20	E	S	45·20
21	E	S	45·19
Nov. 2	E	N	45·12
9	E	N	45·18
Dec. 5	W	N	45·25
12	W	N	45·09
Mean			45·172
Δ_1			·004
Δ_2			·001
Mean R.A.			0 51 45·177

***h* Piscium**
Dec. 28° 30′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	0 52 57·65
Oct. 18	E	S	57·65
20	E	S	57·68
21	E	S	57·67
Nov. 2	E	N	57·68
8	E	S	57·69
9	E	N	57·71
27	W	S	57·66
Dec. 5	W	N	57·67
9	W	N	57·65
10	W	S	57·67
12	W	N	57·71
Mean			57·674
Δ_2			·000
Mean R.A.			0 52 57·674

72 Piscium
Dec. 14° 28′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 7	E	S	1 00 20·14
Nov. 2	E	N	20·15
8	E	S	20·16
27	W	S	20·16
Dec. 5	W	N	20·14
Mean			20·150
Δ_1			−·001
Δ_2			·000
Mean R.A.			1 00 20·149

Bradley 109
Dec. 79° 32′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 27	W	S	1 01 29·10
Dec. 10	W	S	29·14
12	W	N	29·35
Mean			29·197
Δ_2			−·023
Mean R.A.			1 01 29·174

μ Cassiopeiae
Dec. 54° 29′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	1 02 16·53
Nov. 2	E	N	16·36
8	E	S	16·49
27	W	S	16·53
Dec. 5	W	N	16·53
9	W	N	16·47
Mean			16·485
Δ_1			·004
Δ_2			·000
Mean R.A.			1 02 16·489

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 41
Dec. 79° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 27	W	S	1 04 27·58
Nov. 8	E	S	27·44
27	W	S	27·47r
Dec. 9	W	N	27·64

Mean 27·533
Δ1 ·003
Δ2 −·008

Mean R.A. 1 04 27·528

B.J. 43
Dec. 29° 37′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Nov. 2	E	N	1 06 41·95
Dec. 5	W	N	41·97
9	W	N	41·94

Mean 41·953
Δ1 −·001
Δ2 −·002

Mean R.A. 1 06 41·950

Bradley 155
Dec. 77° 06′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 27	W	S	1 12 47·93
Nov. 8	E	S	47·82
27	W	S	47·91
Dec. 8	W	S	47·87

Mean 47·883
Δ2 −·003

Mean R.A. 1 12 47·880

B.J. 42
Dec. 35° 09′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	1 04 41·33
Nov. 2	E	N	41·29
Dec. 5	W	N	41·30
12	W	N	41·33

Mean 41·313
Δ1 −·002
Δ2 −·001

Mean R.A. 1 04 41·310

Bradley 137
Dec. 79° 26′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 27	W	S	1 08 30·60
Nov. 8	E	S	30·54r
Dec. 5	W	N	31·08
9	W	N	30·30
10	W	S	30·31r
12	W	N	30·82

Mean 30·608
Δ2 −·016

Mean R.A. 1 08 30·592

B.J. 45
Dec. 26° 47′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	1 14 30·98
Nov. 27	W	S	30·93
Dec. 5	W	N	30·95
9	W	N	30·95
12	W	N	30·94

Mean 30·950
Δ1 −·001
Δ2 ·000

Mean R.A. 1 14 30·949

χ Piscium
Dec. 20° 33′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	1 06 36·82
Nov. 8	E	S	36·78
27	W	S	36·78
Dec. 10	W	S	36·73
12	W	N	36·81

Mean 36·784
Δ2 ·001

Mean R.A. 1 06 36·785

Bradley 151
Dec. 71° 16′

Date	Clamp	Observer	Mean R.A. 1910·0
Nov. 2	E	N	1 09 42·68
27	W	S	42·80
Dec. 5	W	N	42·94
9	W	N	42·61
12	W	N	42·59

Mean 42·724
Δ2 −·011

Mean R.A. 1 09 42·713

Bradley 166
Dec. 78° 15′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 27	W	S	1 15 48·82
Nov. 8	E	S	48·74
Dec. 8	W	S	48·82
12	W	N	48·81

Mean 48·798
Δ2 −·008

Mean R.A. 1 15 48·790

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

Date	Clamp	Observer	Mean R.A. 1910·0
***l* Piscium Dec. 28° 16′**			
			h m s
Sept. 7	E	S	1 16 08·55
Nov. 27	W	S	08·57
Dec. 5	W	N	08·61
9	W	N	08·68
Mean			08·603
Δ_2			·000
Mean R.A.			1 16 08·603
ξ Andromedae Dec. 45° 03′			
Nov. 8	E	S	1 17 02·09
Dec. 5	W	N	02·06
8	W	S	02·09
9	W	N	02·12
Mean			02·090
Δ_2			−·001
Mean R.A.			1 17 02·089
B.J. 46 Dec. 67° 40′			
Nov. 8	E	S	1 19 33·59
27	W	S	33·62
Dec. 12	W	N	33·60
Mean			33·603
Δ_1			·002
Δ_2			−·002
Mean R.A.			1 19 33·603
B.J. 48 Dec. 59° 46′			
Sept. 7	E	S	1 19 54·97
27	W	S	55·01
Dec. 5	W	N	55·15
8	W	S	55·11
9	W	N	55·18

Date	Clamp	Observer	Mean R.A. 1910·0
B.J. 48 (continued)			
			h m s
Mean			1 19 55·084
Δ_1			−·003
Δ_2			−·004
Mean R.A.			1 19 55·077
ω Andromedae Dec. 44° 57′			
Sept. 7	E	S	1 22 15·91
Nov. 27	W	S	15·89
Dec. 5	W	N	16·02
8	W	S	15·89
9	W	N	16·04
10	W	S	15·95
12	W	N	15·91
Mean			15·944
Δ_2			−·002
Mean R.A.			1 22 15·942
B.J. 51 Dec. 72° 35′			
Dec. 9	W	N	1 31 18·140
Δ_1			−·001
Δ_2			−·019
Mean R.A.			1 31 18·120
υ Andromedae Dec. 40° 57′			
Nov. 8	E	S	1 31 30·49
27	W	S	30·58
Dec. 5	W	N	30·60
12	W	N	30·54
21	W	N	30·70r
Mean			30·582
Δ_1			·001
Δ_2			−·002
Mean R.A.			1 31 30·581

Date	Clamp	Observer	Mean R.A. 1910·0
π Piscium Dec. 11° 41′			
			h m s
Dec. 8	W	S	1 32 19·54
10	W	S	19·55
Mean			19·545
Δ_1			−·004
Δ_2			·003
Mean R.A.			1 32 19·544
B.J. 52 Dec. 48° 10′			
Sept. 27	W	S	1 32 27·66
Dec. 21	W	N	27·80
Mean			27·730
Δ_1			·004
Δ_2			−·003
Mean R.A.			1 32 27·731
τ Andromedae Dec. 40° 07′			
Nov. 8	E	S	1 35 15·68
27	W	S	15·75r
Dec. 10	W	S	15·73
12	W	N	15·71r
21	W	N	15·76
Mean			15·726
Δ_2			−·001
Mean R.A.			1 35 15·725
B.J. 55 Dec. 67° 35′			
Dec. 5	W	N	1 35 39·80
9	W	N	39·78
Mean			39·790
Δ_1			·000
Δ_2			−·014
Mean R.A.			1 35 39·776

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

42 Cassiopeiae
Dec. 70° 10′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 27	W	S	1 35 55·88
Dec. 8	W	S	55·94
Mean			55·910
Δ_2			−·007
Mean R.A.			1 35 55·903

B.J. 57
Dec. 50° 14′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	1 38 00·66
27	W	S	00·72
Nov. 8	E	S	00·68
27	W	S	00·65r
Dec. 5	W	N	00·78
8	W	S	00·78
9	W	N	00·72r
10	W	S	00·76r
12	W	N	00·73
21	W	N	00·77r
Mean			00·725
Δ_1			·001
Δ_2			−·002
Mean R.A.			1 38 00·724

2 Persei
Dec. 50° 21′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	1 46 25·46
27	W	S	25·53r
Nov. 8	E	S	25·34r
27	W	S	25·46
Dec. 5	W	N	25·57r
8	W	S	25·45r
9	W	N	25·40
10	W	S	25·56
12	W	N	25·38r
21	W	N	25·47
Mean			25·462
Δ_2			−·002
Mean R.A.			1 46 25·460

B.J. 63
Dec. 63° 14′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Nov. 27	W	S	1 47 54·41
Dec. 9	W	N	54·53
12	W	N	54·43
Mean			54·457
Δ_1			·001
Δ_2			−·009
Mean R.A.			1 47 54·449

B.J. 64
Dec. 29° 08′

Date	Clamp	Observer	Mean R.A. 1910·0
Dec. 5	W	N	1 47 56·79
8	W	S	56·86
10	W	S	56·83
21	W	N	56·94
Mean			56·855
Δ_1			−·004
Δ_2			·000
Mean R.A.			1 47 56·851

γ Arietis
Dec. 18° 51′

Date	Clamp	Observer	Mean R.A. 1910·0
Nov. 8	E	S	1 48 35·310
Δ_2			·001
Mean R.A.			1 48 35·311

B.J. 66
Dec. 20° 22′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	1 49 39·92
Nov. 8	E	S	39·91
Dec. 5	W	N	39·90
8	W	S	39·91
9	W	N	39·89
12	W	N	39·93
21	W	N	39·98
Mean			39·920
Δ_1			·004
Δ_2			·000
Mean R.A.			1 49 39·924

λ Arietis
Dec. 23° 09′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Nov. 8	E	S	1 52 54·58r
Dec. 12	W	N	54·62
21	W	N	54·63
Mean			54·610
Δ_2			−·001
Mean R.A.			1 52 54·609

Bradley 246
Dec. 77° 29′

Date	Clamp	Observer	Mean R.A. 1910·0
Dec. 8	W	S	1 53 48·26
12	W	N	48·16
Mean			48·210
Δ_2			−·021
Mean R.A.			1 53 48·189

48 Cassiopeiae
Dec. 70° 28′

Date	Clamp	Observer	Mean R.A. 1910·0
Nov. 8	E	S	1 54 32·54
Dec. 5	W	N	33·03
9	W	N	32·78
10	W	S	32·62
Mean			32·743
Δ_2			−·006
Mean R.A.			1 54 32·737

Groombridge 422
Dec. 73° 25′

Date	Clamp	Observer	Mean R.A. 1910·0
Dec. 8	W	S	1 55 10·910
Δ_2			−·009
Mean R.A.			1 55 10·901

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 70
Dec. 71° 59′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Nov. 8	E	S	1 55 43·58
Dec. 5	W	N	43·91
9	W	N	43·58
12	W	N	43·60
21	W	N	43·63

Mean 43·660
Δ_1 ·004
Δ_2 −·011
Mean R.A. 1 55 43·653

47 Cassiopeiae
Dec. 76° 51′

Date	Clamp	Observer	Mean R.A. 1910·0
Dec. 10	W	S	1 56 04·460

Δ_2 −·013
Mean R.A. 1 56 04·447

Groombridge 424
Dec. 80° 52′

Date	Clamp	Observer	Mean R.A. 1910·0
Nov. 8	E	S	1 58 15·590r

Δ_2 ·040
Mean R.A. 1 58 15·630

B.J. 73
Dec. 41° 54′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	1 58 22·14
Dec. 5	W	N	22·16
9	W	N	22·17
12	W	N	22·11
21	W	N	22·20

Mean 22·156
Δ_1 ·002
Δ_2 −·002
Mean R.A. 1 58 22·156

B.J. 74
Dec. 23° 02′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 7	E	S	2 02 05·79
Nov. 8	E	S	05·81
Dec. 8	W	S	05·82
9	W	N	05·81
12	W	N	05·80
21	W	N	05·77

Mean 05·800
Δ_1 ·004
Δ_2 ·000
Mean R.A. 2 02 05·804

B.J. 75
Dec. 34° 34′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	2 04 11·04
Dec. 5	W	N	11·02
9	W	N	10·96r
12	W	N	11·04
21	W	N	10·96r

Mean 11·004
Δ_1 ·001
Δ_2 −·002
Mean R.A. 2 04 11·003

Bradley 282
Dec. 73° 36′

Date	Clamp	Observer	Mean R.A. 1910·0
Nov. 8	E	S	2 05 02·03
Dec. 10	W	S	02·13

Mean 02·080
Δ_2 ·006
Mean R.A. 2 05 02·086

15 Arietis
Dec. 19° 05′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Dec. 5	W	N	2 05 38·16
8	W	S	38·10
9	W	N	38·05r
12	W	N	38·16
21	W	N	38·11r

Mean 38·116
Δ_2 ·000
Mean R.A. 2 05 38·116

B.J. 76
Dec. 66° 06′

Date	Clamp	Observer	Mean R.A. 1910·0
Dec. 8	W	S	2 07 24·35
10	W	S	24·32
21	W	N	24·34

Mean 24·337
Δ_1 ·001
Δ_2 −·008
Mean R.A. 2 07 24·330

B.J. 77
Dec. 50° 39′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	2 07 36·71
Dec. 5	W	N	36·98
9	W	N	36·73
12	W	N	36·81

Mean 36·808
Δ_1 −·002
Δ_2 −·004
Mean R.A. 2 07 36·802

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

B.J. 79
Dec. 33° 26′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 7	E	S	2 11 57·62
Dec. 5	W	N	57·58
8	W	S	57·62
9	W	N	57·58
10	W	S	57·57
12	W	N	57·55r
21	W	N	57·59

Mean 57·587
Δ_1 ·004
Δ_2 −·001

Mean R.A. 2 11 57·590

B.J. 81
Dec. 19° 29′

Date	Clamp	Observer	Mean R.A. 1910·0
Dec. 5	W	N	2 13 06·95
8	W	S	06·98
9	W	N	06·96
10	W	S	06·96
12	W	N	06·98r
21	W	N	06·96

Mean 06·965
Δ_1 −·001
Δ_2 ·000

Mean R.A. 2 13 06·964

ξ Arietis
Dec. 10° 12′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	2 19 59·43
Dec. 8	W	S	59·47
10	W	S	59·47
21	W	N	59·49

Mean 59·465
Δ_2 ·002

Mean R.A. 2 19 59·467

ι Cassiopeiae
Dec. 67° 00′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Dec. 5	W	N	2 21 38·19
9	W	N	37·91r
12	W	N	38·01
21	W	N	38·00r

Mean 38·028
Δ_1 ·003
Δ_2 −·014

Mean R.A. 2 21 38·017

27 Arietis
Dec. 17° 18′

Date	Clamp	Observer	Mean R.A. 1910·0
Sept. 7	E	S	2 25 54·67
Dec. 8	W	S	54·71
9	W	N	54·70
10	W	S	54·64r
12	W	N	54·75
21	W	N	54·75

Mean 54·703
Δ_2 ·001

Mean R.A. 2 25 54·704

B.J. 87
Dec. 72° 26′

Date	Clamp	Observer	Mean R.A. 1910·0
Dec. 5	W	N	2 29 27·49
8	W	S	27·10
9	W	N	27·16
10	W	S	27·17
12	W	N	27·13
21	W	N	27·09

Mean 27·190
Δ_1 ·000
Δ_2 −·016

Mean R.A. 2 29 27·174

B.J. 89
Dec. 21° 34′

Date	Clamp	Observer	Mean R.A. 1910·0
			h m s
Sept. 7	E	S	2 33 42·18
Dec. 5	W	N	42·17
9	W	N	42·16
12	W	N	42·21
21	W	N	42·19

Mean 42·182
Δ_1 −·004
Δ_2 −·001

Mean R.A. 2 33 42·177

Bradley 344
Dec. 81° 04′

Date	Clamp	Observer	Mean R.A. 1910·0
Dec. 10	W	S	2 34 44·530rn

Δ_2 −·021

Mean R.A. 2 34 44·509

B.J. 92
Dec. 67° 27′

Date	Clamp	Observer	Mean R.A. 1910·0
Dec. 5	W	N	2 37 04·22
9	W	N	04·30
10	W	S	04·12
12	W	N	04·04r
21	W	N	04·08

Mean 04·152
Δ_1 −·002
Δ_2 −·012

Mean R.A. 2 37 04·138

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

Date	Clamp	Observer	Mean R.A. 1910·0
B.J. 93 Dec. 48° 51′			
			h m s
Sept. 7	E	S	2 38 02·78
Dec. 5	W	N	02·92
8	W	S	02·79
9	W	N	02·86
12	W	N	02·75
Mean			02·820
Δ_1			−·004
Δ_2			−·003
Mean R.A.			2 38 02·813
B.J. 94 Dec. 27° 19′			
Dec. 10	W	S	2 38 10·00
21	W	N	10·02
Mean			10·010
Δ_1			·000
Δ_2			·000
Mean R.A.			2 38 10·010
39 Arietis Dec. 28° 52′			
Sept. 7	E	S	2 42 32·70
Dec. 5	W	N	32·78
8	W	S	32·82
9	W	N	32·80
10	W	S	32·74
12	W	N	32·82
21	W	N	32·84
Mean			32·786
Δ_2			·000
Mean R.A.			2 42 32·786
B.J. 99 Dec. 55° 31′			
			h m s
Sept. 7	E	S	2 44 07·35
Dec. 8	W	S	07·40
9	W	N	07·44
10	W	S	07·31
Mean			07·375
Δ_1			·004
Δ_2			−·001
Mean R.A.			2 44 07·378
B.J. 100 Dec. 26° 53′			
Dec. 5	W	N	2 44 40·99
12	W	N	40·98
21	W	N	41·01
Mean			40·993
Δ_1			−·002
Δ_2			−·002
Mean R.A.			2 44 40·989
σ Arietis Dec. 14° 43′			
Sept. 7	E	S	2 46 31·20
Dec. 5	W	N	31·34
8	W	S	31·31
9	W	N	31·35
10	W	S	31·25
12	W	N	31·26
21	W	N	31·26
Mean			31·281
Δ_1			·003
Δ_2			·001
Mean R.A.			2 46 31·285
B.J. 103 Dec. 52° 24′			
			h m s
Sept. 7	E	S	2 47 52·14
Dec. 5	W	N	52·29
8	W	S	52·17
9	W	N	52·24
10	W	S	52·16
12	W	N	52·13
21	W	N	52·23
Mean			52·194
Δ_1			·003
Δ_2			−·003
Mean R.A.			2 47 52·194
ε Arietis (mean) Dec. 20° 59′			
Sept. 7	E	S	2 54 03·710
Δ_1			·000
Δ_2			·002
Mean R.A.			2 54 03·712
B.J. 105 Dec. 79° 04′			
Dec. 10	W	S	2 54 04·84
12	W	N	04·81
21	W	N	04·54
Mean			04·730
Δ_1			−·001
Δ_2			−·028
Mean R.A.			2 54 04·701
Bradley 396 Dec. 81° 07′			
Dec. 10	W	S	2 57 41·140m
Δ_2			−·021
Mean R.A.			2 57 41·119

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Continued.*

Date	Clamp	Observer	Mean R.A. 1910·0
B.J. 108 Dec. 53° 09′			
			h m s
Sept. 7	E	S	2 58 16·17
Dec. 5	W	N	16·32
9	W	N	16·19
12	W	N	16·24
21	W	N	16·26
Mean			16·236
Δ_1			−·003
Δ_2			−·005
Mean R.A.			2 58 16·228
B.J. 109 Dec. 38° 30′			
Sept. 7	E	S	2 59 24·24
Dec. 5	W	N	24·32
8	W	S	24·26
9	W	N	24·39
10	W	S	24·28
12	W	N	24·26
21	W	N	24·29
Mean			24·291
Δ_1			·000
Δ_2			−·001
Mean R.A.			2 59 24·290
Bradley 417 Dec. 74° 03′			
Dec. 10	W	S	3 02 09·360
Δ_2			−·010
Mean R.A.			3 02 09·350

Date	Clamp	Observer	Mean R.A. 1910·0
B.J. 111 Dec. 40° 37′			
			h m s
Dec. 12	W	N	3 02 18·46
21	W	N	18·45
Mean			18·455
Δ_1			·004
Δ_2			−·004
Mean R.A.			3 02 18·455
B.J. 112 Dec. 49° 16′			
Sept. 7	E	S	3 02 33·980
Δ_1			·001
Δ_2			·006
Mean R.A.			3 02 33·987
ζ Arietis Dec. 20° 43′			
Sept. 7	E	S	3 09 43·540
Δ_1			−·003
Δ_2			·002
Mean R.A.			3 09 43·539
τ Arietis Dec. 20° 49′			
Sept. 7	E	S	3 16 01·61
Dec. 10	W	S	01·64
Mean			01·625
Δ_1			−·005
Δ_2			·002
Mean R.A.			3 16 01·622

Date	Clamp	Observer	Mean R.A. 1910·0
B.J. 120 Dec. 49° 32′			
			h m s
Dec. 10	W	S	3 17 53·530
Δ_1			−·002
Δ_2			−·002
Mean R.A.			3 17 53·526
Bradley 459 Dec. 71° 33′			
Dec. 10	W	S	3 20 58·460
Δ_2			−·008
Mean R.A.			3 20 58·452
B.J. 122 Dec. 59° 38′			
Dec. 21	W	N	3 21 46·240
Δ_1			·001
Δ_2			−·009
Mean R.A.			3 21 46·232
B.J. 124 Dec. 47° 41′			
Dec. 21	W	N	3 24 13·390
Δ_1			·004
Δ_2			−·005
Mean R.A.			3 24 13·389

LEDGERS OF MEAN RIGHT ASCENSION, 1910·0—*Concluded.*

Date	Clamp	Observer	Mean R.A. 1910·0
s Tauri, Dec. 11° 02′			
Dec. 21	W	N	h m s 3 25 29·160
Δ_2			−·001
Mean R.A.			3 25 29·159
B.J. 129, Dec. 62° 56′			
Dec 21	W	N	3 34 19·960
Δ_1			·000
Δ_2			−·012
Mean R.A.			3 34 19·948
11 Tauri, Dec. 25° 02′			
Dec. 21	W	N	3 35 23·560
Δ_1			·000
Δ_2			−·002
Mean R.A.			3 35 23·558
B.J. 131, Dec. 47° 30′			
Dec. 21	W	N	3 36 30·620
Δ_1			·001
Δ_2			−·005
Mean R.A.			3 36 30·616
B.J. 132, Dec. 32° 00′			
Dec. 21	W	N	h m s 3 38 40·100
Δ_1			·003
Δ_2			−·003
Mean R.A.			3 38 40·100
B.J. 136, Dec. 23° 50′			
Dec. 21	W	N	3 39 31·630
Δ_1			−·001
Δ_2			−·002
Mean R.A.			3 39 31·627
B.J. 139, Dec. 23° 50′			
Dec. 21	W	N	3 42 07·890
Δ_1			·003
Δ_2			−·002
Mean R.A.			3 42 07·891
B.J. 144, Dec. 31° 37′			
Dec. 21	W	N	3 48 28·150
Δ_1			−·004
Δ_2			−·003
Mean R.A.			3 48 28·143
B.J. 145, Dec. 60° 51′			
Dec. 21	W	N	h m s 3 49 27·110
Δ_1			·000
Δ_2			−·010
Mean R.A.			3 49 27·100
B.J. 147, Dec. 39° 45′			
Dec. 21	W	N	3 51 48·570
Δ_1			−·005
Δ_2			−·004
Mean R.A.			3 51 48·561
B.J. 148, Dec. 35° 32′			
Dec. 21	W	N	3 53 07·300
Δ_1			−·005
Δ_2			−·003
Mean R.A.			3 53 07·292
B.J. 150, Dec. 12° 14′			
Dec. 21	W	N	3 55 41·610
Δ_1			−·001
Δ_2			−·001
Mean R.A.			3 55 41·608

MEAN RIGHT ASCENSIONS OF STARS OBSERVED IN 1910

No.	Star	Mag.	Dec.	Mean R.A. 1910·0	Mean date 1910+	No. of Observations	O.–B.J.	O.–B.	O.–G.	O.–N.	Notes
			° ′	h m s							
1	B.J. 1	2·1	28 36	0 03 43·947	·87	4	....	....	....	....	
2	Bradley 3217	6·3	79 13	04 20·813*	·83	7	....	....	....	....	Comes 7m; close binary.
3	B.J. 2	2·2	58 39	04 22·047	·85	2	....	....	....	....	
4	B.J. 4	5·2	45 34	05 38·272†	·84	7	....	....	....	....	
5	B.J. 7	2·7	14 41	08 35·965	·85	10	–·008	–·013	–·011	–·024	
6	B.J. 8	6·5	76 27	0 11 06·480	·84	9	....	....	....	....	
7	σ Andromedae	4·5	36 17	13 37·295†	·84	10	....	....	....	–·065	
8	ρ Andromedae	5·4	37 28	16 22·592*	·84	10	....	....	....	....	
9	Bradley 34	6·4	76 31	25 07·200*	·85	10	....	....	....	....	
10	B.J. 16	4·2	62 26	27 52·520	·90	5	....	....	....	....	
11	B.J. 17	3·8	53 24	0 31 56·994	·86	10	–·025	–·020	–·036	–·100	
12	B.J. 18	4·2	33 13	32 04·174	·82	3	....	....	....	....	
13	B.J. 19	4·3	28 49	33 47·769†	·84	7	....	....	....	....	
14	B.J. 20	3·2	30 22	34 30·694	·86	7	....	....	....	....	
15	B.J. 21	2·2	56 03	35 23·508	·81	9	....	....	....	....	
16	B.J. 24	5·8	74 30	0 39 41·219	·84	8	....	....	....	....	
17	B.J. 25	4·7	47 48	39 42·237	·86	5	....	....	....	....	
18	23 Cassiopeiae	5·7	74 21	41 44·328*	·83	7	....	....	....	....	
19	B.D. 71·37	6·0	72 11	42 15·456*	·90	4	....	....	....	....	
20	B.J. 27	4·1	23 47	42 33·919	·83	3	....	....	....	....	
21	η Cassiopeiae	3·6	57 20	0 43 39·098†	·85	11	....	....	....	·195	Comes 7·6m, 5″ s. pr.; binary.
22	ν Andromedae	4·5	40 35	44 50·705†	·85	12	....	....	....	–·055	C. D. T.
23	B.J. 29	5·7	63 45	45 15·238	·85	1	....	....	....	....	
24	B.J. 32	2·0	60 14	51 16·040	·90	3	....	....	....	....	
25	B.J. 33	3·9	38 01	51 45·177	·82	9	....	....	....	....	

MEAN RIGHT ASCENSIONS OF STARS OBSERVED IN 1910 (continued)

No.	Star	Mag.	Dec.	Mean R.A. 1910·0	Mean date 1910+	No. of Observations	O.−B.J.	O.−B.	O.−G.	O.−N.	Notes
			° ′	h m s							
26	*h* Piscium	5·7	28 30	0 52 57·674*	·86	12	......	......	......	......	
27	72 Piscium	5·6	14 28	1 00 20·149†	·84	5	......	......	......	......	
28	Bradley 109	6·4	79 32	01 29·174*	·88	3	......	......	......	......	
29	μ Cassiopeiae	5·3	54 29	02 16·489†	·86	6	......	......	......	......	
30	B.J. 41	5·7	79 12	04 27·528	·86	4	......	......	......	......	
31	B.J. 42	2·1	35 09	1 04 41·310	·85	4	......	......	......	......	
32	χ Piscium	4·7	20 33	06 36·785*	·87	5	......	......	......	......	
33	B.J. 43	4·3	29 37	06 41·950†	·90	3	......	......	......	......	
34	Bradley 137	6·5	79 26	08 30·592*	·89	6	......	......	......	......	
35	Bradley 151	6·1	71 16	09 42·713*	·91	5	......	......	......	......	
36	Bradley 155	6·4	77 06	1 12 47·880*	·86	4	......	......	......	......	
37	B.J. 45	4·6	26 47	14 30·949	·88	5	......	......	......	......	
38	Bradley 166	6·2	78 15	15 48·790*	·87	4	......	......	......	......	
39	*l* Piscium	5·3	28 16	16 08·603*	·86	4	......	......	......	......	
40	ξ Andromedae	4·9	45 03	17 02·089*	·91	4	......	......	......	......	
41	B.J. 46	5·0	67 40	1 19 33·603	·90	3	......	......	......	......	
42	B.J. 48	2·7	59 46	19 55·077	·85	5	......	......	......	......	
43	ω Andromedae	4·9	44 57	22 15·942*	·90	7	......	......	......	......	
44	B.J. 51	5·5	72 35	31 18·120	·94	1	......	......	......	......	
45	υ Andromedae	4·2	40 57	31 30·581†	·92	5	......	......	......	......	
46	π Piscium	5·6	11 41	1 32 19·544†	·94	2	......	......	......	......	
47	B.J. 52	3·6	48 10	32 27·731	·86	2	......	......	......	......	
48	τ Andromedae	5·3	40 07	35 15·725*	·92	5	......	......	......	......	
49	B.J. 55	5·9	67 35	35 39·776	·93	2	......	......	......	......	
50	42 Cassiopeiae	5·4	70 10	35 55·903*	·84	2	......	......	......	......	

51	B.J. 57	4·1	50 14	1 38 00·724	·88	10	— ·007	— ·011	— ·012	— ·034	
52	2 Persei	5·6	50 21	46 25·460*	·88	10	......	......	......	......	
53	B.J. 63	3·3	63 14	47 54·449	·93	3	......	......	......	......	
54	B.J. 64	3·5	29 08	47 56·851	·94	4	......	......	......	......	
55	γ Arietis	4·7	18 51	48 35·311*	·85	1	......	......	......	......	Double, 9″; south star.
56	B.J. 66	2·7	20 22	1 49 39·924	·89	7	......	......	......	......	
57	λ Arietis	5·0	23 09	52 54·609*	·92	3	......	......	......	......	
58	Bradley 246	6·1	77 29	53 48·189*	·94	2	......	......	......	......	
59	48 Cassiopeiae	4·7	70 28	54 32·737*	·92	4	......	......	......	......	
60	Groombridge 422	6·4	73 25	55 10·901*	·94	1	......	......	......	......	Comes 8m, 5″.
61	B.J. 70	4·0	71 59	1 55 43·653	·93	5	......	......	......	......	
62	47 Cassiopeiae	5·4	76 51	56 04·447*	·94	1	......	......	......	......	
63	Groombridge 424	6·3	80 52	58 15·630*	·85	1	......	......	......	......	
64	B.J. 73	2·1	41 54	1 58 22·156	·89	5	......	......	......	......	Comes 6m, 10″.
65	B.J. 74	2·0	23 02	2 02 05·804	·89	6	......	......	......	......	
66	B.J. 75	3·0	34 34	2 04 11·003	·89	5	......	......	......	......	
67	Bradley 282	6·4	73 36	05 02·086*	·90	2	......	......	......	......	
68	15 Arietis	5·9	19 05	05 38·116*	·94	5	......	......	......	......	
69	B.J. 76	6·3	66 06	07 24·330	·95	3	......	......	......	......	
70	B.J. 77	5·7	50 39	07 36·802†	·87	4	......	......	......	......	
71	B.J. 79	4·2	33 26	2 11 57·590†	·91	7	......	......	......	......	
72	B.J. 81	5·7	19 29	13 06·964†	·94	6	......	......	......	......	
73	ξ Arietis	5·8	10 12	19 59·467*	·88	4	......	......	......	......	
74	ι Cassiopeiae	4·6	67 00	21 38·017†	·95	4	......	......	......	......	Triple, 7m, 2″, 8m, 8″.
75	27 Arietis	6·5	17 18	25 54·704*	·90	6	......	......	......	......	
76	B.J. 87	5·4	72 26	2 29 27·174	·94	6	......	......	......	......	
77	B.J. 89	5·6	21 34	33 42·177	·89	5	......	......	......	......	
78	Bradley 344	5·9	81 04	34 44·509*	·94	1	......	......	......	......	
79	B.J. 92	6·3	67 27	37 04·138	·95	5	......	......	......	......	
80	B.J. 93	4·1	48 51	38 02·813	·89	5	......	......	......	......	
81	B.J. 94	4·7	27 19	2 38 10·010	·96	2	......	......	......	......	
82	39 Arietis	4·8	28 52	42 32·786*	·91	7	......	......	......	......	
83	B.J. 99	3·8	55 31	44 07·378†	·88	4	......	......	......	......	
84	B.J. 100	3·6	26 53	44 40·989	·95	3	......	......	......	......	
85	σ Arietis	5·5	14 43	46 31·285†	·91	7	......	......	......	......	

MEAN RIGHT ASCENSIONS OF STARS OBSERVED IN 1910 (continued)

No.	Star	Mag.	Dec.	Mean R.A. 1910·0	Mean date 1910+	No. of Observations	O.–B.J.	O.–B.	O.–G.	O.–N.	Notes
			° ′	h m s							
86	B.J. 103	4·0	52 24	2 47 52·194	·91	7	....	....	....	....	
87	ε Arietis (mean)	4·6	20 59	54 03·712†	·68	1	....	....	....	....	Double, 5·2m, 5·6m, 1·2″.
88	B.J. 105	5·8	79 04	54 04·701	·95	3	....	....	....	....	Comes 9m, 5″.
89	Bradley 396	6·0	81 07	57 41·119*	·94	1	....	....	....	....	
90	B.J. 108	3·0	53 09	58 16·228	·89	5	....	....	....	....	
91	B.J. 109	3·8	38 30	2 59 24·290	·91	7	....	....	....	....	
92	Bradley 417	5·1	74 03	3 02 09·350*	·94	1	....	....	....	....	
93	B.J. 111	2·2	40 37	02 18·455	·96	2	....	....	....	....	
94	B.J. 112	4·1	49 16	02 33·987	·68	1	....	....	....	....	
95	ζ Arietis	5·0	20 43	09 43·539†	·68	1	....	....	....	....	
96	τ Arietis	5·2	20 49	3 16 01·622†	·81	2	....	....	....	....	
97	B.J. 120	1·9	49 32	17 53·526	·94	1	....	....	....	....	
98	Bradley 459	6·5	71 33	20 58·452*	·94	1	....	....	....	....	
99	B.J. 122	4·4	59 38	21 46·232	·97	1	....	....	....	....	Comes 9m, 3″.
100	B.J. 124	4·8	47 41	24 13·389	·97	1	....	....	....	....	
101	s Tauri	5·5	11 02	3 25 29·159*	·97	1	....	....	....	....	
102	B.J. 129	5·4	62 56	34 19·948	·97	1	....	....	....	....	
103	11 Tauri	6·7	25 02	35 23·558†	·97	1	....	....	....	....	
104	B.J. 131	3·0	47 30	36 30·616	·97	1	....	....	....	....	
105	B.J. 132	3·9	32 00	38 40·100	·97	1	....	....	....	....	Comes 8·5m, 1″.
106	B.J. 136	4·0	23 50	3 39 31·627†	·97	1	....	....	....	....	
107	B.J. 139	3·0	23 50	42 07·891	·97	1	....	....	....	....	
108	B.J. 144	2·9	31 37	48 28·143	·97	1	....	....	....	....	
109	B.J. 145	5·5	60 51	49 27·100	·97	1	....	....	....	....	Comes 8m, 2″ n.f.
110	B.J. 147	3·0	39 45	51 48·561	·97	1	....	....	....	....	Comes 8m, 9″ n.f.

111	B.J. 148	4·0	35 32	3 53 07·292	·97	1					
112	B.J. 150	3·5	12 14	3 55 41·608	·97	1					
113	B.J. 296	5·5	33 38	7 41 42·364	·21	1					
114	B.J. 314	4·4	43 29	8 16 40·653	·21	1					
115	B.J. 320	6·3	38 20	27 04·138	·21	2					
116	B.J. 323	6·3	53 02	8 32 37·887	·21	2					
117	B.J. 335	2·9	48 24	53 03·036	·21	1					
118	B.J. 339	3·9	42 08	54 48·082	·21	2					
119	B.J 341	3·3	47 31	8 57 29·153	·21	2					
120	B.A.C. 3097	4·7	38 49	9 00 48·513†	·21	2					
121	B.J. 346	5·3	43 35	9 07 55·333	·21	2					
122	B.J. 349	3·9	37 11	13 14·883	·21	2					Comes 6·7m, 3″.
123	B.J. 352	3·2	34 46	15 34·611	·32	1					
124	B.J. 358	3·1	52 05	26 50·659	·27	9					
125	B.J. 360	4·6	36 48	28 42·824	·28	8					
126	B.J. 368	3·8	59 28	9 44 35·954	·27	9					
127	B.J. 374	5·2	41 29	9 52 10·601†	·27	10	− ·028	− ·011		·002	
128	B.J. 379	3·4	17 12	10 02 25·734	·33	1					
129	B.J. 383	3·4	43 22	11 40·443	·27	12	·005	·007	− ·018	− ·033	
130	B.J. 384	3·4	23 52	11 41·241	·33	1					
131	B.J. 386	3·0	41 57	10 16 58·335	·26	3					
132	B.J. 390	4·2	37 10	22 40·971	·29	10	− ·027	− ·015		− ·050	
133	B.J. 394	4·8	56 27	24 52·457	·28	12	− ·040	− ·033		− ·083	
134	B.J. 398	5·2	57 33	29 22·304	·27	13	− ·059	− ·057			
135	37 Leonis Minoris	4·8	32 27	33 39·528†	·29	12				·008	C.D.T.
136	B.J. 405	5·2	23 40	10 38 31·499†	·34	2					
137	B.J. 407	5·3	31 09	40 51·819	·29	11	− ·015	·008	− ·050	·005	
138	B.J. 412	3·9	34 42	48 16·921†	·29	12	− ·013	− ·009	·027	− ·005	
139	54 Leonis	4·5	25 14	50 44·554†	·34	3					Comes 6·3m, 6·4″ s.f.
140	47 Ursae Majoris	5·1	40 55	54 25·787*	·31	12					
141	B.J. 416	2·3	56 52	10 56 25·048	·30	15	− ·029	− ·037	− ·056	− ·056	
142	B.J. 420	3·0	44 59	11 04 36·472	·30	15	− ·032	− ·041	·000	− ·066	
143	B.J. 422	2·4	21 01	09 19·415	·35	5					
144	B.J. 424	6·1	49 58	11 37·851	·30	14	·018	·030			
145	B.J. 425	3·4	33 35	13 37·246	·31	13	− ·007	·000		− ·013	

MEAN RIGHT ASCENSIONS OF STARS OBSERVED IN 1910 (continued)

No.	Star	Mag.	Dec.	Mean R.A. 1910·0	Mean date 1910+	No. of Observations	O.−B.J.	O.−B.	O.−G.	O.−N.	Notes
			° ′	h m s							
146	B.J. 432..........	6·1	43 40	11 25 39·099	·34	3	....	....	....	....	
147	B.J. 441..........	3·8	48 17	41 18·089	·33	11	−·060	−·051	−·023	−·096	
148	B.J. 444..........	2·1	15 05	44 28·201	·35	8	....	....	....	....	
149	Groombridge 1830..	6·5	38 22	47 47·704†	·33	12	....	·009	....	−·029	
150	B.J. 447..........	2·3	54 12	49 06·074	·33	9	....	....	....	....	
151	*o* Leonis..........	5·8	16 09	11 51 02·876*	·36	8	....	....	....	....	
152	1 Can. Venaticorum	6·2	53 56	12 10 15·917*	·34	11	....	....	....	....	
153	B.J. 456..........	3·4	57 32	10 58·537	·31	3	....	....	....	....	
154	B.J. 458..........	5·9	41 10	11 37·103†	·34	12	−·059	....	....	−·138	Comes 8m, 11·6″ s.pr.
155	12 Comae..........	4·8	26 21	17 58·978†	·36	5	....	....	....	....	Comes 9m, 7″.
156	B.J. 461..........	5·3	39 31	12 21 25·038	·34	15	−·028	−·012	....	....	
157	15 Comae..........	4·5	28 46	22 27·271*	·37	9	....	....	....	....	
158	B.J. 466..........	6·0	21 24	25 12·045	·36	6	....	....	....	....	Comes 10m, 2″.
159	B.J. 467..........	5·6	58 54	25 45·384	·31	8	....	....	....	....	
160	B.J. 470..........	4·3	41 51	29 28·250	·34	16	−·043	−·026	....	−·091	
161	23 Comae..........	4·9	23 07	12 30 22·078†	·36	8	....	....	....	....	
162	9 Can. Venaticorum	6·2	41 22	34 26·536*	·35	12	....	....	....	....	
163	31 Comae..........	5·1	28 02	47 18·967†	·35	6	....	....	....	....	
164	B.J. 483..........	1·7	56 27	50 04·298	·35	7	....	....	....	....	
165	B.J. 485..........	2·8	38 48	12 51 49·204	·36	18	·014	·004	·048	·023	Comes 5m, 19·8″ s.pr.
166	14 Can. Venaticorum	5·5	36 17	13 01 32·039*	·37	18	....	....	....	....	
167	15 Can. Venaticorum	6·5	39 01	05 33·590*	·39	8	....	....	....	....	
168	B.J. 491..........	6·1	38 59	05 55·347	·37	16	−·020	·007	....	....	Comes 10m, 1·4″.
169	B.J. 492..........	4·2	28 20	07 40·463	·37	14	−·016	−·009	−·045	−·037	
170	19 Can. Venaticorum	5·7	41 20	11 29·251*	·36	17	....	....	....	....	

171	B.J. 494............	4·6	41 03	13 13 30·507†	·36	19	—·028	—·011	....	—·070	
172	23 Can. Venaticorum	5·7	40 37	16 17·060*	·37	19	....	....	....	....	
173	B.J. 497............	2·2	55 24	20 18·202	·37	21	—·041	—·063	—·098	—·090	Comes 4m, 14″.
174	81 Ursae Majoris...	5·4	55 49	30 39·698*	·36	2	....	....	....	....	
175	B.J. 502............	4·9	37 39	30 46·778	·40	17	·015	·009	....	—·021	
176	25 Can. Venaticorum	5·1	36 45	13 33 27·797†	·38	21	....	....	·006	·027	C. D. T. 8m, 1″; binary.
177	B.J. 507............	4·5	17 54	42 59·113	·40	21	—·006	—·004	—·021	—·002	
178	B.J. 509............	1·8	49 46	43 59·700	·39	23	—·057	—·058	—·037	—·064	
179	B.J. 513............	2·8	18 51	50 23·979	·40	18	·013	·010	·015	·008	
180	B.J. 517............	6·3	27 49	13 57 05·644	·40	15	—·020	·005	....	—·034	
181	9 H. Boötis.........	5·4	44 17	14 04 19·920*	·40	16	....	....	....	....	
182	B.J. 522............	4·9	25 31	06 17·683	·40	16	—·011	·010	—·006	—·021	
183	B.J. 526............	1	19 39	11 33·396	·40	18	·039	·020	·050	·043	
184	B.J. 527............	4·0	46 30	12 57·758	·38	16	—·035	—·020	....	—·065	
185	B.J. 528............	4·6	51 47	12 58·750	·46	3	....	....	....	....	
186	B.J. 531............	3·9	52 16	14 22 07·981	·44	11	—·022	—·007	....	—·045	
187	f Boötis............	5.4	19 38	22 16·176†	·46	9	....	....	....	....	
188	g Boötis............	5·7	50 15	25 29·972*	·45	6	....	....	....	....	
189	204 B. Boötis........	5·7	42 12	26 03·981*	·39	14	....	....	....	....	
190	5 Ursae Minoris....	4·4	76 06	27 42·222†	·49	2	....	....	....	....	
191	B.J. 534............	3·7	30 46	14 27 57·080	·41	19	—·012	—·002	—·010	—·022	
192	B.J. 535............	2·9	38 42	28 27·269	·43	9	....	....	....	....	
193	σ Boötis............	4·5	30 08	30 45·711†	·42	20	....	....	....	—·033	
194	B.J. 540............	5·5	44 48	35 29·260†	·41	18	—·018	·001	....	—·070	
195	B.D. 80.448.........	6·4	80 03	36 05·559*	·49	2	....	....	....	....	
196	B.J. 543............	3·6	14 07	14 36 51·045	·42	17	·015	....	·040	·005	C.D.T. Close equal double.
197	34 Boötis...........	4·9	26 55	39 28·048*	·42	17	....	....	....	....	
198	ε Boötis............	2·7	27 27	41 03·415†	·42	17	....	·012	·012	·022	Comes 5·1m, 2·8″ n.pr.
199	295 B. Boötis........	6·4	38 11	45 34·694*	·42	18	....	....	....	....	
200	ξ Boötis............	4·8	19 28	47 14·109*	·42	17	....	....	....	....	Comes 7m, 3″; binary.
201	B.J. 549............	5·8	59 40	14 49 09·227	·43	16	—·012	·001	....	—·057	
202	B.J. 550............	2·0	74 31	50 57·371	·49	3	....	....	....	....	
203	B.J. 551............	6·0	14 49	51 58·296	·43	13	—·019	·000	....	·010	
204	Groombridge 2184..	6·5	78 32	55 09·553*	·49	3	....	....	....	....	
205	B.J. 555............	3·3	40 45	14 58 33·335	·44	17	—·018	—·007	·010	—·027	

MEAN RIGHT ASCENSIONS OF STARS OBSERVED IN 1910 (continued)

No.	Star	Mag.	Dec.	Mean R.A. 1910·0	Mean date 1910+	No. of Observations	O.−B.J.	O.−B.	O.−G.	O.−N.	Notes
			° ′	h m s							
206	B.J. 557	4·5	27 18	15 00 35·356	·44	13	·015	·019	·015	·014	
207	*i* Boötis	4·9	48 00	00 49·439*	·42	2	....	....	....	....	Comes 6m, 6″.
208	*c* Boötis	5·0	25 13	03 20·866†	·41	9	....	....	....	....	
209	B.J. 563	3·2	33 39	11 52·461	·45	18	·001	·002	·044	−·010	
210	11 Ursae Minoris	5·1	72 09	17 09·651*	·50	5	....	....	....	....	
211	*η* Cor. Borealis	5·0	30 37	15 19 29·168†	·45	16	....	....	−·028	−·002	C.D.T. Close equal binary.
212	B.J. 569	3·0	72 09	20 51·761	·50	4	....	....	....	....	
213	B.J. 568	4·1	37 42	21 05·399	·44	14	−·011	·001	....	−·032	
214	B.J. 571	3·2	59 17	22 55·502	·46	17	−·056	−·045	−·077	−·158	
215	B.J. 572	3·7	29 25	24 07·086	·44	13	−·007	−·002	−·015	−·020	
216	B.J. 573	4·8	41 08	15 27 41·756	·45	20	−·021	−·002	....	−·040	
217	*ν*² Boötis	5·0	41 12	28 33·638*	·45	19	....	....	....	....	
218	B.J. 576	4·1	31 40	29 18·000	·46	11	−·005	....	....	....	
219	B.J. 578	2·2	27 01	30 52·643	·44	16	·024	·019	·019	·027	
220	*θ* Ursae Minoris	5·1	77 39	34 03·972*	·50	5	....	....	....	....	
221	B.J. 580	5·3	40 39	15 34 35·628	·44	14	−·034	−·013	....	....	
222	*ζ* Cor. Borealis	5·1	36 56	35 59·281†	·44	16	....	....	....	−·054	Comes 6m, 6·2″ n.pr.
223	*ι* Serpentis	4·8	19 58	37 32·272*	·45	17	....	....	....	....	
224	B.J. 581	3·8	26 35	38 57·759	·45	16	−·026	....	....	....	Comes 7m; close binary.
225	B.J. 583	3·4	15 42	42 01·988	·45	17	−·014	−·013	−·043	−·047	
226	B.J. 584	4·0	18 25	15 44 41·266	·45	17	−·022	−·016	....	−·001	
227	B.J. 590	4·3	78 04	47 14·995	·50	5	....	....	....	....	
228	*χ* Herculis	4·5	42 42	49 33·765†	·46	20	....	....	....	−·065	C.D.T.
229	B.J. 591	3·7	15 57	52 17·704†	·45	18	−·006	−·006	·011	−·015	
230	B.J. 593	4·0	27 08	53 51·648	·45	18	·001	·014	....	·015	

231	B.J. 595	5·1	55 00	15 55 39·183	·46	20	—·012	—·005			
232	r Herculis	5·3	18 04	15 57 11·639*	·45	18					
233	B.J. 598	3·8	58 48	16 00 11·990	·46	20	—·083	—·078		—·137	
234	κ Herculis	5·3	17 17	04 00·751†	·46	15				·049	
235	τ Cor. Borealis	5·0	36 43	05 40·781*	·45	11					
236	B.J. 601	4·0	45 10	16 05 56·087†	·42	2					
237	σ^2 Cor. Borealis	5·8	34 05	11 18·502†	·47	12				·034	Comes 6·7m, 4·6″ s.pr.
238	B.J. 606	5·8	76 06	13 22·447	·50	5					
239	20 Ursae Minoris	6·4	75 26	14 47·152*	·53	1					
240	Groombridge 2337	6·3	73 37	16 01·524*	·49	3					
241	B.J. 608	3·6	46 32	16 17 02·067	·47	8					
242	B.J. 609	3·5	19 22	17 56·951	·40	2					
243	ξ Cor. Borealis	5·0	31 06	18 35·387*	·49	10					
244	23 Herculis	6·7	32 33	19 29·147*	·46	8					
245	B.J. 612	5·1	75 58	20 07·321†	·51	4					
246	B.J. 613	4·7	14 14	16 21 15·679†	·46	8					
247	B.J. 614	5·8	55 25	22 27·118	·49	12	—·051	—·035			
248	g Herculis	5·4	42 05	25 41·114*	·48	15					
249	B.J. 618	2·6	21 41	26 21·011	·51	1					
250	Groombridge 2372	5·8	79 09	30 43·022*	·51	6					
251	B.J. 621	4·1	42 37	16 31 12·040	·45	9					
252	B.D. 72·734	6·4	72 48	32 50·586*	·51	6					
253	B.J. 623	6·5	77 38	34 30·016	·52	4					
254	42 Herculis	5·1	49 06	36 18·212*	·46	4					
255	ζ Herculis	3·0	31 46	37 53·612†	·47	10			—·011	·023	Comes 6m, 1″; binary.
256	B.J. 626	3·3	39 06	16 39 48·598	·48	16	—·013	·001	·002	·004	
257	B.D. 79·511	6·4	79 05	42 58·821*	·51	6					
258	B.J. 627	4·9	56 57	43 35·248	·47	10	—·065	—·055		—·138	
259	Groombridge 2391	6·3	77 40	47 05·704*	·51	4					
260	B.J. 629	6·5	15 07	47 58·975	·48	8					
261	53 Herculis	5·7	31 51	16 49 33·230*	·49	15					
262	Groombridge 2411	6·5	73 16	58 03·484*	·52	7					
263	d Herculis	5·3	33 42	16 58 16·958†	·49	7					
264	B.J. 635	4·9	12 52	17 01 12·242	·51	10	—·001	—·006			
265	B.D. 75·612	6·9	75 21	03 13·338*	·55	4					

MEAN RIGHT ASCENSIONS OF STARS OBSERVED IN 1910 (continued)

No.	Star	Mag.	Dec.	Mean R.A. 1910·0	Mean date 1910+	No. of Observations	O.−B.J.	O.−B.	O.−G.	O.−N.	Notes
			° ′	h m s							
266	Groombridge 2427	6·4	75 25	17 04 29·443*	·53	6					
267	B.J. 636	6·4	40 38	04 50·506	·49	6					
268	B.J. 640	3·0	14 30	10 32·608	·51	7					Comes 6m, 4·6″ s.f.
269	B.J. 643	3·1	36 55	11 54·703	·51	15	−·016	−·016	·009	·006	
270	*u* Herculis	5·0	33 12	14 00·012*	·51	5					
271	*e* Herculis	4·8	37 23	17 14 34·007*	·52	9					
272	*w* Herculis	5·4	32 35	17 17·448†	·51	14		−·031		−·018	
273	ρ Herculis	4·4	37 14	20 34·639*	·51	15					Comes 5m, 4″.
274	B.J. 650	6·0	48 20	24 21·032	·53	14	−·051	−·024			
275	Groombridge 2456	5·8	80 13	26 25·497*	·55	9					
276	λ Herculis	4·5	26 11	17 27 06·034†	·50	5					
277	B.J. 653	2·7	52 22	28 23·872	·52	13	−·046	−·048	−·070	−·041	
278	B.J. 655	4·7	55 15	30 24·104	·54	6					
279	B.J. 657	4·8	55 14	30 29·500	·63	1					
280	B.J. 656	2·1	12 37	30 45·378	·54	3					
281	B.J. 663	3·6	46 03	17 36 55·398	·52	14	−·028	−·011	−·007	−·074	
282	B.D. 72·800	6·0	72 30	38 50·986*	·58	5					
283	B.J. 667	3·3	27 46	42 56·127	·51	5					
284	B.J. 670	4·7	72 12	43 32·214	·58	5					
285	87 Herculis	5·3	25 39	45 10·163*	·55	9					
286	*z* Herculis	6·4	48 25	17 47 42·003*	·55	11					
287	168 H[1]. Herculis	6·1	40 00	49 08·953*	·55	11					
288	89 Herculis	5·5	26 04	51 47·286†	·56	8					
289	B.J. 671	3·6	56 53	51 58·270	·43	1					
290	B.J. 672	3·8	37 16	53 09·956	·51	6					

291	B.J. 675	5·1	76 59	17 53 28·583	·60	4	....	....	....	....	
292	B.J. 674	3·7	29 15	54 15·998†	·51	1	....	....	....	....	
293	B.J. 676	2·3	51 30	54 30·896	·50	3	....	....	....	....	
294	B.D. 78·616	6·3	78 19	55 14·634*	·60	5	....	....	....	....	
295	ψ^2 Draconis	5·7	72 01	17 56 44·622*	·61	5	....	....	....	....	
296	B.J. 681	3·8	28 45	18 04 01·889	·59	6	....	....	....	....	
297	40 Draconis	5·2	79 59	06 46·887*	·61	8	....	....	....	....	
298	B.J. 684	5·6	42 08	12 50·783†	·58	12	—·003	·003	....	—·010	
299	446 B. Herculis	5·6	23 14	18 23·475*	·59	10	....	....	....	....	
300	B.J. 690	3·9	21 44	19 51·757	·59	11	·004	·008	—·022	·007	
301	μ Lyrae	5·4	39 27	18 21 15·896*	·59	9	....	....	....	....	
302	B.J. 693	4·3	71 17	22 02·994	·63	3	....	....	....	....	Comes 7m, 0·4″.
303	B.J. 694	5·1	58 45	22 35·752	·57	7	....	....	....	....	Comes 8m, 3″.
304	B.J. 695	3·6	72 42	22 40·811	·62	4	....	....	....	....	
305	B.J. 699	1	38 42	33 53·460	·59	10	—·004	—·018	·011	—·015	
306	B.J. 700	6·1	77 29	18 34 06·134	·61	5	....	....	....	....	
307	B.J. 703	4·1	20 28	41 47·293	·61	10	·001	·012	—·009	·034	
308	111 Herculis	4·4	18 05	43 02·787*	·61	11	....	....	....	....	
309	Bradley 2382	6·4	70 42	44 11·720*	·62	9	....	....	....	....	
310	204 B. Draconis	5·8	52 53	44 42·387*	·59	7	....	....	....	....	
311	B.J. 705	3·3	33 15	18 46 45·397	·61	14	—·023	—·023	—·020	—·019	
312	Groombridge 2719	5·4	73 59	48 01·592*	·62	9	....	....	....	....	
313	50 Draconis	5·4	75 20	49 17·002†	·63	9	....	....	....	....	
314	B.J. 707	4·6	59 17	49 52·410	·59	7	....	....	....	....	
315	B.D. 79·604	6·6	79 50	52 00·040*	·62	6	....	....	....	....	
316	B.J. 711	4·5	43 50	18 52 35·764	·60	9	....	....	....	....	
317	B.J. 714	5·0	71 11	55 30·195	·65	5	....	....	....	....	
318	B.J. 713	3·2	32 34	18 55 34·621	·60	8	....	....	....	....	
319	B.J. 716	3·0	13 44	19 01 16·405	·43	1	....	....	....	....	
320	B.J. 719	5·2	35 58	04 05·375†	·60	18	—·028	—·007	....	—·056	
321	19 Lyrae	6·1	31 08	19 08 18·871*	·60	4	....	....	....	....	
322	B.J. 725	5·4	11 26	13 35·484	·60	5	....	....	....	....	
323	B.J. 726	3·8	53 12	15 01·364	·63	13	—·040	—·039	—·113	—·051	
324	159 B.Lyrae	6·6	40 12	15 57·567*	·54	4	....	....	....	....	
325	B.J. 729	4·5	73 11	17 17·391	·63	8	....	....	....	....	

MEAN RIGHT ASCENSIONS OF STARS OBSERVED IN 1910 (continued)

No.	Star	Mag.	Dec.	Mean R.A. 1910·0	Mean date 1910+	No. of Observations	O.−B.J.	O.−B.	O.−G.	O.−N.	Notes
			° ′	h m s							
326	*b* Aquilae	5·3	11 45	19 20 40·708†	·64	16		−·019		−·042	C.D.T.
327	21 B.Vulpeculae	6·4	24 45	21 42·281*	·63	18					
328	4 Cygni	5·4	36 08	22 54·619*	·63	21					
329	B.D. 76·734	6·2	76 23	24 46·269*	·65	9					
330	*α* Vulpeculae	4·6	24 29	24 57·623†	·64	15		·011	·004	·017	
331	B.J. 732	3·0	27 46	19 27 05·516	·65	10	·024	·020	·005	·022	
332	B.J. 734	6·4	79 25	27 09·250	·65	9					
333	B.J. 733	3·9	51 32	27 26·224	·62	4					
334	8 Cygni	4·9	34 16	28 25·605*	·66	19					
335	B.D. 70·1073	6·2	70 48	31 43·735*	·65	12					
336	*ε* Sagittae	5·7	16 16	19 33 12·937*	·55	4					
337	B.D. 49·3059	6·3	50 02	33 31·238*	·66	18					
338	B.J. 738	4·5	50 01	34 01·677	·65	21	·002	·021		−·024	
339	14 Cygni	5·4	42 37	36 30·690*	·63	15					
340	*β* Sagittae	4·4	17 16	37 00·413†	·66	9					
341	10 Vulpeculae	5·6	25 33	19 39 58·374*	·67	19					
342	B.J. 740	5·2	37 08	41 01·833†	·66	22	·000			−·052	
343	B.J. 742	2·8	44 55	42 09·706	·65	21	−·030	−·028	−·014	−·059	Comes 8m, 1·6″ n.pr.
344	B.J. 743	3·8	18 19	43 22·491	·68	16	·011	·018	·023	·000	
345	*ζ* Sagittae	5·2	18 55	44 58·947*	·67	18					Comes 9m, 9″.
346	B.J. 747	3·8	70 02	19 48 28·933	·64	8					Comes 7·6m, 3·1″n.
347	*φ* Aquilae	5·4	11 11	51 58·537*	·67	21					
348	B.J. 750	5·0	52 12	53 18·190	·67	19	−·010	·003			Comes 8m, 3″.
349	B.J. 752	3·6	19 15	54 45·278	·66	20	·013	·015		·018	
350	15 Vulpeculae	4·9	27 30	57 23·623*	·67	20		·008			

351	B.D. 69·1084	6·4	70 07	19 58 55·313*	·67	14	....	....	....	....	
352	69 Draconis	6·3	76 14	20 02 08·924*	·69	10	....	....	....	....	
353	b^2 Cygni	5·2	36 34	06 05·028*	·69	11	....	....	....	....	
354	20 Vulpeculae	6·2	26 13	08 14·228*	·72	10	....	....	....	....	
355	ρ Aquilae	5·1	14 55	10 06·758*	·73	5	....	....	....	....	
356	30 Cygni	4·2	46 33	20 10 28·291*	·68	4	....	....	....	....	
357	B.J. 757	4·3	46 28	10 47·847	·70	4	....	....	....	....	
358	B.J. 759	4·3	77 26	11 56·201	·71	10	−·005	−·094	....	−·069	Comes 8m, 7·5″ s.f.
359	B.J. 760	5·7	24 24	12 56·002	·64	9	....	....	....	....	
360	176 B.Cygni	6·6	39 07	16 59·459*	·69	22	....	....	....	....	
361	B.J. 765	2·3	39 58	20 18 59·865	·69	26	−·007	−·012	·017	−·014	
362	40 Cygni	5·9	38 09	24 14·168*	·69	27	....	....	....	....	
363	41 Cygni	4·1	30 04	25 43·062†	·69	28	....	−·023	....	−·075	
364	ω^1 Cygni	5·6	48 39	27 16·267*	·70	25	....	....	....	....	
365	B.J. 768	3·9	11 00	28 54·802	·71	22	·002	−·002	·011	−·010	
366	Groombridge 3241	6·4	72 14	20 30 24·329†	·69	13	....	....	....	·143	
367	ζ Delphini	4·8	14 22	31 06·054*	·71	17	....	....	....	....	
368	B.J. 770	5·3	74 39	32 42·352	·70	17	−·039	−·064	−·114	....	
369	B.J. 771	3·5	14 17	33 19·729	·71	12	·008	·007	·005	−·028	Binary 4m, 5m, 0·5″.
370	29 Vulpeculae	5·0	20 53	34 30·125*	·72	19	....	....	....	....	
371	74 Draconis	6·3	80 47	20 34 42·038*	·70	7	....	....	....	....	
372	B.J. 774	3·7	15 36	35 27·470	·72	21	·001	·008	·019	−·010	
373	B.J. 777	1·3	44 57	38 21·776	·72	26	−·028	−·026	−·011	−·030	
374	B.J. 778	4·2	14 45	39 15·441†	·73	24	·007	·014	....	·002	
375	B.J. 780	2·4	33 38	42 34·117	·72	27	−·039	−·042	−·042	−·060	
376	B.J. 782	4·5	57 15	20 43 07·082	·70	3	....	....	....	....	
377	B.J. 784	4·6	36 10	43 54·134	·72	25	−·006	·011	....	....	Comes 7m, 0·7″.
378	220 H^1.Draconis	5·6	80 13	51 41·952†	·74	15	....	−·168	....	−·133	
379	B.J. 788	3·9	40 49	53 49·007	·72	27	−·030	−·006	....	−·034	
380	Bradley 2748	6·3	75 35	55 48·609*	·73	17	....	....	....	....	
381	f^1 Cygni	4·8	47 10	20 56 45·872*	·73	16	....	....	....	....	
382	B.J. 792	3·9	43 34	21 01 39·358†	·72	23	−·052	−·028	−·037	−·048	
383	B.J. 793	5·4	38 18	02 51·725	·72	17	·010	....	−·016	·056	
384	f^2 Cygni	4·9	47 17	03 30·009*	·73	16	....	....	....	....	
385	Groombridge 3409	6·2	71 04	05 51·349*	·72	17	....	....	....	....	

MEAN RIGHT ASCENSIONS OF STARS OBSERVED IN 1910 (continued)

No.	Star	Mag.	Dec.	Mean R.A. 1910·0	Mean date 1910+	No. of Observations	O.−B.J.	O.−B.	O.−G.	O.−N.	Notes
			° ′	h m s							
386	B.J. 795	6·0	77 46	21 07 18·925	·74	14	−·086	−·111	−·135	−·247	
387	B.J. 797	3·1	29 51	09 06·313	·70	6	...	...	...	...	
388	B.J. 798	5·8	59 37	09 30·744	·73	18	−·050	−·032	...	...	Comes 7m, 1″.
389	B.J. 799	3·8	37 40	11 11·861†	·72	24	−·002	...	·007	−·017	Comes 7m, 0·8″ pr.; binary.
390	σ Cygni	4·3	39 01	13 52·759†	·71	15	...	−·022	−·065	−·059	
391	υ Cygni	4·6	34 31	21 14 12·960*	·74	11	...	...	...	...	
392	Bradley 2796	6·1	76 38	16 41·848*	·73	9	...	...	...	...	
393	B.J. 804	4·2	19 25	17 55·425	·74	13	−·009	·005	...	−·021	
394	69 Cygni	6·2	36 17	22 06·275*	·73	26	...	...	...	...	
395	B.J. 807	5·4	46 09	26 07·630†	·73	20	−·010	·014	...	−·023	
396	B.J. 809	3·1	70 10	21 27 30·163	·73	10	−·036	−·039	−·050	−·063	
397	Groombridge 3511	6·3	80 08	27 30·228*	·78	3	...	...	...	...	
398	ρ Cygni	4·2	45 12	30 35·643*	·73	12	...	...	...	...	
399	72 Cygni	5·0	38 08	31 05·906*	·74	12	...	...	...	...	
400	B.J. 811	5·1	40 01	33 20·412	·74	25	−·014	·005	...	−·056	
401	B.J. 813	6·1	57 05	21 36 10·015	·74	24	−·059	...	...	...	Triple; 7m, 12″; 7m, 20″.
402	B.J. 816	4·1	25 14	40 34·121	·74	9	...	...	...	...	Close double, 0·1″.
403	B.J. 817	4·8	70 54	40 36·357†	·74	18	−·057	−·062	...	−·038	
404	78 Draconis	5·3	71 54	41 58·582*	·74	18	...	...	...	...	
405	B.J. 821	4·3	48 54	43 28·013	·74	25	−·015	·012	...	−·025	
406	14 Pegasi	5·4	29 45	21 45 51·718*	·75	24	...	...	...	...	
407	B.J. 823	5·2	25 30	48 57·956	·75	22	−·019	·000	−·016	−·028	
408	Bradley 2868	7·2	55 47	50 04·993*	·74	23	...	...	...	...	
409	79 Draconis	6·6	73 17	51 44·092†	·74	8	...	...	...	...	
410	13 Cephei	6·1	56 11	51 51·550*	·75	18	...	...	...	...	

411	B.J. 826	5·8	12 41	21 56 42·247†	·73	13	—·005	·014		—·013	
412	Bradley 2897	6·4	74 34	56 59·794*	·76	13					
413	16 Cephei	5·2	72 45	21 57 57·997*	·77	16					
414	B.J. 831	3·9	24 54	22 02 49·205†	·75	23	—·008	—·011	—·011	—·032	
415	B.J. 833	5·8	32 44	05 14·259	·75	26	—·038				
416	B.J. 835	4·3	32 44	22 05 59·333	·75	20	—·001	·013		—·026	
417	28 Pegasi	6·6	20 32	06 14·884*	·76	6					
418	B.J. 836	3·4	57 45	07 43·813	·75	11	·016	·020	—·005	—·007	
419	B.J. 837	4·8	71 54	08 04·785	·76	15	·000	—·013	—·031	·006	
420	1 H. Lacertae	4·6	39 16	10 00·816*	·76	26					
421	Bradley 2942	6·3	72 52	22 11 15·103*	·76	16					
422	B.J. 844	4·5	51 47	20 01·135	·75	1					
423	B.D. 70·1240	5·7	70 19	23 41·069*	·77	15					
424	B.J. 847	4·1	57 57	25 49·572	·78	11	—·041	—·021			
425	38 Pegasi	5·7	32 07	25 54·710*	·80	4					
426	28 Cephei	6·1	78 20	22 26 02·256*	·73	6					
427	B.J. 848	3·8	49 49	27 34·837	·77	21	—·041	—·033		—·088	
428	29 Cephei	5·6	78 22	29 05·519*	·77	14					
429	226 B. Cephei	5·7	75 46	30 41·667†	·79	11		—·082		—·107	
430	B.J. 851	5·2	73 11	33 32·704	·78	16	—·021	—·037			
431	B.J. 852	4·9	38 35	22 35 13·221	·78	12	—·032	—·011		—·061	
432	Groombridge 3857	5·9	74 54	35 17·274*	·76	8					
433	B.J. 853	5·3	63 07	35 27·107	·85	1					
434	B.J. 855	3·3	10 22	36 58·386	·79	17	·010	·011	·018	·000	
435	B.J. 857	2·9	29 45	38 46·888	·78	15	—·009	·002	—·015	—·015	
436	B.J. 858	5·4	41 21	22 40 04·479	·78	18	—·029	—·016			
437	B.J. 859	3·9	23 06	42 11·698	·78	16	·017	·018		·023	
438	B.J. 862	3·6	24 08	45 39·463†	·78	13	—·015	—·010	—·010	—·034	
439	B.J. 863	3·5	65 44	46 28·344	·87	2					
440	52 Pegasi	6·1	11 15	54 41·623*	·79	15					Comes 8m, 1″.
441	B.J. 869	3·5	41 51	22 57 46·611	·78	19	—·042	—·030		—·025	
442	B.J. 870	2·4	27 36	22 59 24·580	·78	12	·015	·007	—·022	·007	
443	B.J. 871	2·4	14 43	23 00 16·611	·80	10	·011	·007	·014	·012	
444	5 Andromedae	5·8	48 48	03 39·892*	·79	14					
445	B.J. 874	4·5	74 54	05 01·868	·79	15	—·057	—·059	—·159	—·073	Comes 7m, 1″ n.f.

MEAN RIGHT ASCENSIONS OF STARS OBSERVED IN 1910 (concluded)

No.	Star	Mag.	Dec.	Mean R.A. 1910·0	Mean date 1910+	No. of Observations	O.−B.J.	O.−B.	O.−G.	O.−N.	Notes
			° ′	h m s							
446	B.J. 875	5·8	56 40	23 08 56·611	·79	18	−·066	−·051	......	−·139	
447	Bradley 3085	6·2	73 44	11 24·826*	·79	12	......	......	......	......	
448	Bradley 3086	5·8	70 24	12 09·030*	·83	3	......	......	......	......	
449	Groombridge 4033	6·5	74 48	14 08·293*	·80	12	......	......	......	......	
450	o Cephei	4·9	67 37	14 55·263†	·85	2	......	......	......	......	Comes 8m, 3″ s.pr.
451	B.J. 880	4·5	23 15	23 16 10·834	·81	14	−·004	−·012	·002	·008	
452	B.J. 882	5·5	61 47	20 50·117	·90	2	......	......	......	......	
453	B.J. 881	4·4	22 55	20 53·140†	·80	13	·001	·008	·050	·006	
454	B.J. 885	4·7	12 16	24 36·127	·82	12	·012	·018	......	·013	
455	1 H.Cassiopeiae	4·9	58 03	25 52·275*	·80	3	......	......	......	......	Multiple; 10m, 1″.
456	15 Andromedae	6·0	39 44	23 30 13·141*	·86	3	......	......	......	......	
457	Bradley 3140	5·9	71 09	31 04·191*	·82	4	......	......	......	......	
458	B.J. 890	3·8	45 58	33 09·263†	·82	12	−·041	−·016	......	−·071	
459	B.J. 891	4·1	42 46	33 43·079	·79	3	......	......	......	......	
460	Groombridge 4119	6·2	74 48	35 18·002*	·80	5	......	......	......	......	
461	B.J. 893	3·3	77 08	23 35 38·281	·84	1	......	......	......	......	
462	κ Andromedae	4·3	43 50	35 58·233	·81	5	......	......	......	......	
463	ψ Andromedae	5·1	45 55	41 34·157	·81	11	......	......	......	−·067	
464	B.J. 895	5·2	67 18	43 35·933	·88	6	......	......	......	......	
465	B.J. 898	5·4	18 37	47 54·458	·79	4	......	......	......	......	
466	Groombridge 4154	6·5	75 03	23 48 00·613*	·84	7	......	......	......	......	
467	B.J. 899	4·8	57 00	49 52·786†	·79	4	......	......	......	......	
468	Groombridge 4163	6·6	73 55	50 26·317	·85	8	......	......	......	......	
469	ψ Pegasi	4·8	24 38	53 10·214*	·83	12	......	......	......	......	

APPENDIX 4.

REPORT OF THE CHIEF ASTRONOMER, 1911.

TABULAR STATEMENT OF LONGITUDE AND LATITUDE OBSERVATIONS

BY

J. MACARA.

CONTENTS

MAP.

APPENDIX 4.

TABULAR STATEMENT OF LONGITUDE AND LATITUDE OBSERVATIONS.

OTTAWA, CANADA,
1st April, 1911.

W. F. KING, LL.D., C.M.G.,
Chief Astronomer,
Department of the Interior,
Ottawa.

SIR,—
I have the honour to transmit herewith a tabular statement of the differences of longitude and the latitude results of stations observed in 1910; and, of four other stations, Erwood and Macdowall in Saskatchewan and Lloydminster and Stonyplain in Alberta, observed in 1909 by exchange of signals with the transit house, on Fort Osborne barracks ground, at Winnipeg. The longitude of the latter station was determined early in the summer of 1910, by telegraphic exchange of time with the Dominion Observatory.

This report also contains a statement, arranged in alphabetical order, giving the longitude and the latitude of the various astronomical stations established up to the present time. The small differences between the longitudes given herein and those previously published are due to the adjustment of the longitude triangles comprising Seattle, Vancouver, Boundary, Field, Winnipeg, Ottawa, Montreal and Harvard.

The accompanying map shows the positions of the stations.

I have the honour to be, sir,

Your obedient servant,

J. MACARA.

DIFFERENCE OF LONGITUDE BETWEEN ERWOOD, SASK., AND WINNIPEG, MAN.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean	v	
1909	m s	m s	s	s	m s	m s	m s	s	s
Aug. 21.......	19 41·680	19 41·554	−43·127	−14·735	20 10·072	20 09·946	20 10·009	−·073	·063
" 22.......	42·532	42·395	−40·359	−12·856	10·035	09·898	09·962	−·026	·064
" 24.......	44·314	44·178	−35·501	−09·831	09·984	09·848	09·916	·020	·068
" 25.......	44·162	44·033	−34·074	−08·305	09·931	09·802	09·867	·069	·065
" 26.......	44·608	44·457	−32·145	−06·796	09·957	09·806	09·882	·054	·076
" 27.......	44·919	44·779	−30·503	−05·375	10·047	09·907	09·977	−·041	·070
" 28.......	46·264	46·139	−27·559	−03·912	09·911	09·786	09·849	·087	·063
" 29.......	48·180	48·037	−24·073	−02·173	10·080	09·937	10·008	−·072	·071

Observers {West, F. A. McDiarmid.
{East, W. C. Jaques.

	h	m	s
Mean difference of longitude..................		20	09·936
Longitude of Winnipeg..........................	6	28	35·262
Longitude of Erwood...........................	6	48	45·198

DIFFERENCE OF LONGITUDE BETWEEN MACDOWALL, SASK., AND WINNIPEG, MAN.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
1909	m s	m s	m s	s	m s	m s	m s	s	s
Sept. 2......	36 54·999	36 54·902	+1 31·739	+04·387	35 27·647	35 27·550	35 27·599	−·019	·049
" 4......	36 59·591	36 59·530	+1 39·315	+07·368	27·644	27·583	27·613	−·033	·030
" 4	36 59·720	36 59·647	+1 39·581	+07·394	27·533	27·460	27·497	·083	·037
" 6......	37 03·794	37 03·713	+1 47·026	+10·879	27·647	27·566	27·606	−·026	·040
" 6......	37 03·835	37 03·756	+1 47·169	+10·952	27·618	27·539	27·579	·001	·040
" 7......	37 05·143	37 05·060	+1 49·905	+12·373	27·611	27·528	27·570	·010	·042
" 7......	37 05·217	37 05·135	+1 50·005	+12·423	27·635	27·553	27·594	−·014	·041

Observers {West, F. A. McDiarmid.
East, W. C. Jaques.

	h	m	s
Mean difference of longitude....................		35	27·580
Longitude of Winnipeg.........................	6	28	35·262
Longitude of Macdowall.......................	7	04	02·842

DIFFERENCE OF LONGITUDE BETWEEN LLOYDMINSTER, ALTA., AND WINNIPEG, MAN.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
1909	m s	m s	m s	s	m s	m s	m s	s	s
Sept. 9......	52 42·495	52 42·300	1 22·404	06·401	51 26·492	51 26·297	51 26·395	−·042	·098
" 13......	52 50·570	52 50·387	1 35·978	11·906	26·498	26·315	26·406	−·053	·091
" 16......	52 55·146	52 54·959	1 47·157	18·401	26·390	26·203	26·297	+·056	·094
" 20......	53 02·292	53 02·113	2 01·733	25·909	26·468	26·289	26·378	−·025	·089
" 23......	53 11·994	53 11·807	2 17·719	32·108	26·382	26·195	26·289	+·064	·094

Observers {West, F. A. McDiarmid.
East, W. C. Jaques.

	h	m	s
Mean difference of longitude....................		51	26·353
Longitude of Winnipeg..........................	6	28	35·262
Longitude of Lloydminster......................	7	20	01·615

DIFFERENCE OF LONGITUDE BETWEEN STONYPLAIN, ALTA., AND WINNIPEG, MAN.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
1909	h m s	h m s	m s	s	h m s	h m s	h m s	s	s
Sept. 27......	1 08 44·578	1 08 44·389	1 59·565	40·708	1 07 26·721	1 07 26·532	1 07 26·627	—·054	·095
" 28......	08 46·192	08 45·987	2 02·990	42·441	1 07 26·643	1 07 26·438	1 07 26·541	·032	·103
" 30......	08 45·562	08 45·389	2 06·549	46·677	1 07 26·690	1 07 26·517	1 07 26·603	—·030	·086
Oct. 2......	08 49·149	08 48·951	2 14·627	51·166	1 07 26·688	1 07 26·490	1 07 26·589	—·016	·099
" 3......	08 51·988	08 51·763	2 19·569	53·239	1 07 26·658	1 07 26·433	1 07 26·546	·027	·113
" 4......	08 53·756	08 53·563	2 23·154	55·024	1 07 26·626	1 07 26·433	1 07 26·530	·043	·097

Observers {West, F.A. McDiarmid.
East, W. C. Jaques.

	h m s
Mean difference of longitude....................	1 07 26·573
Longitude of Winnipeg.........................	6 28 35·262
Longitude of Stonyplain.......................	7 36 01·835

DIFFERENCE OF LONGITUDE BETWEEN WINNIPEG, MAN., AND DOMINION OBSERVATORY, OTTAWA.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	p	
1910	h m s	h m s	s	s	h m s	h m s	h m s		s
May 14......	1 25 20·415	1 25 20·308	−22·790	+ ·007	1 25 43·212	1 25 43·105	1 25 43·158	½	·053
" 16......	1 25 23·006	1 25 22·878	−20·011	+ ·115	1 25 43·132	1 25 43·004	1 25 43·068	½	·064
" 17......	1 25 24·919	1 25 24·789	−18·237	+ ·165	1 25 43·321	1 25 43·191	1 25 43·256	1	·065
" 18......	1 25 27·015	1 25 26·861	−16·039	+ ·301	1 25 43·355	1 25 43·201	1 25 43·278	½	·077
" 20......	1 25 32·540	1 25 32·389	−10·274	+ ·493	1 25 43·307	1 25 43·156	1 25 43·232	½	·075
" 21......	1 25 34·536	1 25 34·415	−08·261	+ ·545	1 25 43·342	1 25 43·221	1 25 43·281	1	·062
" 25......	1 25 41·142	1 25 41·027	−01·218	+1·014	1 25 43·374	1 25 43·259	1 25 43·316	½	·057
" 26......	1 25 42·215	1 25 42·085	−00·006	+1·128	1 25 43·349	1 25 43·219	1 25 43·284	1	·065
" 29......	1 25 45·166	1 25 45·049	+ 3·175	+1·310	1 25 43·301	1 25 43·184	1 25 43·243	½	·058
June 5......	1 25 59·031	1 25 58·885	+17·649	+1·876	1 25 43·258	1 25 43·112	1 25 43·185	½	·073
" 6......	1 25 60·254	1 25 60·115	+18·940	+1·960	1 25 43·274	1 25 43·135	1 25 43·204	½	·069
" 7......	1 25 61·652	1 25 61·520	+20·344	+2·045	1 25 43·353	1 25 43·221	1 25 43·287	1	·066
" 8......	1 25 61·947	1 25 61·793	+20·850	+2·176	1 25 43·273	1 25 43·119	1 25 43·196	1	·077
" 9......	1 25 61·495	1 25 61·320	+20·363	+2·324	1 25 43·456	1 25 43·281	1 25 43·368	1	·087

Observers { West, F. A. McDiarmid.
East, D. B. Nugent
R. M. Stewart

	h	m	s
Mean difference of longitude....................	1	25	43·251
Longitude of Dominion Observatory.........	5	02	51·983
Correction to Winnipeg longitude due to solving of longitude net..........................		+	·028
Longitude of Winnipeg..........................	6	28	35·262

DIFFERENCE OF LONGITUDE BETWEEN NORTH PORTAL, SASK., AND WINNIPEG, MAN.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean	v	
1910	m s	m s	s	s	m s	m s	m s	s	s
July 12......	23 17·974	23 17·913	+59·895	−41·764	21 36·315	21 36·254	21 36·285	·119	·031
" 13.....	22 35·630	22 35·530	+60·669	+ 1·403	21 36·364	21 36·264	21 36·314	·090	·050
" 14......	22 36·600	22 36·553	+62·069	+ 1·894	21 36·425	21 36·378	21 36·401	·003	·023
" 16......	22 35·109	22 35·065	+62·060	+ 3·301	21 36·350	21 36·306	21 36·428	·076	·022
" 19......	22 34·333	22 34·262	+63·791	+ 6·058	21 36·600	21 36·529	21 36·564	−·160	·035
" 20......	22 34·517	22 34·452	+64·187	+ 6·237	21 36·567	21 36·502	21 36·534	−·130	·032

Observers {West, F. A. McDiarmid. East, W. C. Jaques.

	h	m	s
Mean difference of longitude....................		21	36·404
Longitude of Winnipeg..........................	6	28	35·262
Longitude of North Portal......................	6	50	11·666

DIFFERENCE OF LONGITUDE BETWEEN MORTLACH, SASK., AND WINNIPEG, MAN.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
1910	h m s	h m s	s	s	h m s	h m s	h m s	s	s
July 23......	0 36 13·731	0 36 13·672	+39·645	+6·687	0 35 40·773	0 35 40·714	0 35 40·744	·066	·030
" 24......	0 36 12·518	0 36 12·458	+38·652	+7·003	0 35 40·868	0 35 40·809	0 35 40·839	−·029	·030
" 25......	0 36 11·137	0 36 11·085	+37·640	+7·337	0 35 40·834	0 35 40·782	0 35 40·808	·002	·026
" 26......	0 36 09·778	0 36 09·695	+36·929	+7·952	0 35 40·801	0 35 40·718	0 35 40·760	·050	·042
" 28......	0 36 08·865	0 36 08·785	+36·731	+8·727	0 35 40·861	0 35 40·781	0 35 40·821	−·011	·040
" 29......	0 36 09·138	0 36 09·055	+37·351	+9·140	0 35 40·927	0 35 40·844	0 35 40·885	−·075	·041

Observers {West, F. A. McDiarmid.
East, W. C. Jaques.

	h	m	s
Mean difference of longitude....................	0	35	40·810
Longitude of Winnipeg..........................	6	28	35·262
Longitude of Mortlach..........................	7	04	16·072

DIFFERENCE OF LONGITUDE BETWEEN WALSH, ALTA., AND WINNIPEG, MAN.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
1910	h m s	h m s	s	s	h m s	h m s	h m s	s	s
Aug. 1......	0 52 02·888	0 52 02·743	+37·894	+ 9·391	0 51 34·385	0 51 34·240	0 51 34·312	—·022	·072
" 3......	0 52 01·172	0 52 01·058	+36·761	+10·019	0 51 34·430	0 51 34·316	0 51 34·373	—·083	·057
" 4......	0 52 00·173	0 52 00·046	+35·676	+ 9·894	0 51 34·391	0 51 34·264	0 51 34·327	—·037	·063
" 5......	0 51 59·202	0 51 59·061	+35·060	+10·177	0 51 34·319	0 51 34·178	0 51 34·249	·041	·071
" 6......	0 51 58·404	0 51 58·298	+34·293	+10·242	0 51 34·353	0 51 34·247	0 51 34·300	—·010	·053
" 7......	0 51 56·207	0 51 56·164	+32·212	+10·295	0 51 34·290	0 51 34·177	0 51 34·239	·051	·062
" 8......	0 51 54·933	0 51 54·810	+31·209	+10·621	0 51 34·345	0 51 34·222	0 51 34·283	·007	·061
" 9......	0 51 51·959	0 51 51·878	+28·935	+11·257	0 51 34·281	0 51 34·200	0 51 34·240	·050	·060

Observers {West, F. A. McDiarmid.
{East, W. C. Jaques.

	h m s
Mean difference of longitude....................	0 51 34·290
Longitude of Winnipeg..........................	6 28 35·262
Longitude of Walsh.............................	7 20 09·552

DIFFERENCE OF LONGITUDE BETWEEN PINCHER, ALTA., AND WINNIPEG, MAN.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean	v	
1910	h m s	h m s	s	s	h m s	h m s	h m s	s	s
Aug. 13......	1 06 16·136	1 06 15·949	−41·857	+14·078	1 07 12·071	1 07 11·884	1 07 11·977	·043	·093
" 16......	09·891	09·694	−44·945	+17·375	12·211	12·014	12·112	−·092	·098
" 17......	07·906	07·710	−45·029	+19·212	12·147	11·951	12·049	−·029	·098
" 18......	05·323	05·135	−45·620	+21·092	12·035	11·847	11·911	·079	·094

	h m s
Mean difference of longitude....................	1 07 12·020
Longitude of Winnipeg........................	6 28 35·262
Longitude of Pincher........................	7 35 47·282

Observers {West, F. A. McDiarmid.
East, W. C. Jaques.

DIFFERENCE OF LONGITUDE BETWEEN COUTTS, ALTA., AND WINNIPEG, MAN.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude			v	Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station	Eastern Station	Western Signals.	Eastern Signals.	Mean.		
1910	h m s	h m s	s	s	h m s	h m s	h m s	s	s
Sept. 2......	0 58 15·769	0 58 15·555	−40·252	+19·254	0 59 15·275	0 59 15·061	0 59 15·168	−·037	·107
" 3......	0 58 16·327	0 58 16·110	−41·058	+17·899	0 59 15·284	0 59 15·066	0 59 15·175	−·044	·109
" 8......	0 58 19·110	0 58 18·883	−38·631	+17·443	0 59 15·184	0 59 14·957	0 59 15·071	·060	·114
" 9......	0 58 17·678	0 58 17·463	−39·700	+17·875	0 59 15·253	0 59 15·038	0 59 15·146	−·015	·108
" 11......	0 58 18·778	0 58 18·557	−37·143	+19·256	0 59 15·177	0 59 14·956	0 59 15·067	·064	·111
" 12......	0 58 19·106	0 58 18·873	−35·476	+20·692	0 59 15·274	0 59 15·041	0 59 15·157	−·026	·116

Observers {West, F. A. McDiarmid.
{East. W. C. Jaques.

	h m s
Mean difference of longitude....................	0 59 15·131
Longitude of Winnipeg..........................	6 28 35·262
Longitude of Coutts...........................	7 27 50·393

DIFFERENCE OF LONGITUDE BETWEEN EMERSON, MAN., AND WINNIPEG, MAN.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
1910	h m s	h m s	s	s	h m s	h m s	h m s	s	s
Sept. 17......	0 00 41·923	0 00 42·005	−54·865	+1·874	0 00 14·816	0 00 14·734	0 00 14·775	−·018	·041
" 19......	41·857	41·944	−54·290	+2·422	14·855	14·768	14·811	−·054	·043
" 20......	42·344	42·440	−54·621	+2·442	14·719	14·623	14·671	·086	·048
" 23......	34·934	35·028	−44·921	+4·841	14·826	14·732	14·779	−·022	·047
" 26......	27·065	27·158	−34·660	+7·199	14·794	14·701	14·748	·009	·047

Observers {West. F. A. McDiarmid.
East, W. C. Jaques.

	h	m	s
Mean difference of longitude....................	0	00	14·757
Longitude of Winnipeg..........................	6	28	35·262
Longitude of Emerson..........................	6	28	50·019

DIFFERENCE OF LONGITUDE BETWEEN WINDSOR, ONT., AND DOMINION OBSERVATORY, OTTAWA.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
	h m s	h m s	s	s	h m s	h m s	h m s	s	s
1910 Sept. 30......	0 29 47·063	0 29 46·976	+41·502	+13·984	0 29 19·545	0 29 19·458	0 29 19·502	−·003	·044
Oct. 1......	0 29 48·530	0 29 48·426	+43·099	+14·089	0 29 19·520	0 29 19·416	0 29 19·468	·031	·052
" 2......	0 29 48·170	0 29 48·079	+42·815	+14·192	0 29 19·547	0 29 19·456	0 29 19·501	·002	·045
" 3......	0 29 47·997	0 29 47·919	+42·705	+14·299	0 29 19·591	0 29 19·513	0 29 19·552	−·053	·039
" 4......	0 29 49·345	0 29 49·238	+44·153	+14·446	0 29 19·638	0 29 19·531	0 29 19·584	−·085	·053
" 7......	0 29 52·254	0 29 52·167	+47·707	+14·883	0 29 19·430	0 29 19·343	0 29 19·387	·119	·044

Observers {West, F. A. McDiarmid.
{East, D. B. Nugent.

	h	m	s
Mean difference of longitude....................	0	29	19·499
Longitude of Dominion Observatory	5	02	51·983
Longitude of Windsor..........................	5	32	11·482

DIFFERENCE OF LONGITUDE BETWEEN SAULT STE. MARIE, ONT., AND DOMINION OBSERVATORY, OTTAWA.

Date	Difference of Chronograph		Clock Correction		Difference of Longitude				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean	v	
1910	h m s	h m s	s	s	h m s	h m s	h m s	s	s
Oct. 6......	0 34 11·291	0 34 11·140	−00·950	+14·740	0 34 26·981	0 34 26·830	0 34 26·906	−·091	·076
" 7......	13·024	12·882	+01·074	+14·887	26·837	26·695	26·766	·049	·072
" 9......	15·006	14·858	+03·588	+15·461	26·879	26·731	26·805	·010	·074
" 10......	16·913	16·787	+05·793	+15·749	26·869	26·743	26·806	·009	·063
" 11......	17·889	17·736	+07·045	+16·022	26·866	26·713	26·790	·025	·077

Observers { West, W. C. Jaques.
East, R. M. Stewart.
D. B. Nugent.

	h m s
Mean difference of longitude....................	0 34 26·815
Longitude of Dominion Observatory............	5 02 51·983
Longitude of Sault Ste. Marie....................	5 37 18·798

ASTRONOMICAL POSITIONS OF STATIONS.

OBSERVED, 1885 TO 1910.

Place.	Year.	Difference of Longitude.	Base.	Longitude.	Longitude.	Latitude.
		h m s		h m s	° ′ ″	° ′ ″
Bancroft..........	1909	0 08 34·317	Dom. Obs.........	5 11 26·300	77 51 34·50	45 03 34·52
Barry Bay........	1907	0 07 50·534	"	5 10 42·517	77 40 37·76	45 29 17·11
Bathurst..........	1909	0 40 14·848	"	4 22 37·135	65 39 17·03	47 37 12·95
Beeton............	1904	0 16 17·528	Ottawa...........	5 19 07·550	79 46 53·25	44 04 47·70
Black Lake.... ...	1908	0 17 27·431	Dom. Obs.........	4 45 24·552	71 21 08·28	46 02 44·59
Boiestown.........	1908	0 37 10·990	"	4 25 40·993	66 25 14·90	46 27 18·52
Boundary (Yukon)	1906	1 11 31·626	Vancouver........	9 24 00·030	141 00 00·45	64 40 51·42
Boundary (Waneta)	1908	0 18 49·289	Seattle........ ...	7 50 30·985	117 37 44·78	49 00 00·55
Calgary...........	1886	0 25 03·659	Kamloops..... ...	7 36 15·132	114 03 46·98	51 02 39·21
Campbellton......	1908	0 36 10·364	Dom. Obs.........	4 26 41·619	66 40 24·28	48 00 31·33
Canoe Lake.......	1900	0 12 04·914	Ottawa...........	5 14 54·936	78 43 44·04	45 34 41·55
Chalk River.......	1900	0 06 58·506	"	5 09 48·528	77 27 07·92	46 00 52·32
Chapleau..........	1907	0 30 45·695	Dom. Obs.........	5 33 37·678	83 24 25·17	47 50 31·21
Charlottetown.....	1909	0 50 22·407	"	4 12 29·576	63 07 23·64	46 13 58·48
Cobourg...........	1904	....	....	....	....	43 57 51·40
Cochrane..........	1909	0 21 14·949	Dom. Obs........	5 24 06·932	81 01 43·98	49 03 41·88
Coutts............	1910	0 59 15·131	Winnipeg..........	7 27 50·393	111 57 35·90	49 00 09·01
Covey Hill........	1903	....	. . . .	....	....	45 01 13·35
Dawson...........	1907	0 06 16·131	Boundary...	9 17 43·899	139 25 58·49	64 03 23·15
Digby.............	1909	0 39 50·801	Dom. Obs.........	4 23 01·182	65 45 17·73	44 37 13·58
Dom. Observatory	1905	0 00 01·961	Ottawa (Cliff St.)	5 02 51·983	75 42 59·75	....
Edmonton.........	1888	1 05 27·965	Winnipeg(new Obs)	7 34 01·754	113 30 26·31	53 31 58·81
Edmundston.......	1908	0 29 33·867	Dom. Obs.........	4 33 18·116	68 19 31·74	47 22 06·65
Emerson..........	1910	0 00 14·757	Winnipeg..........	6 28 50·019	97 12 30·29	49 00 04·34
Erwood...........	1909	0 20 09·936	"	6 48 45·198	102 11 17·97	52 51 37·69

ASTRONOMICAL POSITIONS OF STATIONS—*Continued.*

Place.	Year.	Difference of Longitude.	Base.	Longitude.	Longitude.	Latitude.
		h m s		h m s	° ′ ″	° ′ ″
Father Point......	1905	0 28 58·508	Dom. Obs........	4 33 53·475	68 28 22·12	48 31 05·14
Field..............	1886	0 15 18·953	Kamloops.........	7 45 59·864	116 29 57·96	51 23 38·58
Fort Frances......	1908	1 10 44·496	Dom. Obs........	6 13 36·479	93 24 07·18	48 36 48·59
Foster............	1908	0 12 52·932	"	4 49 59·051	72 29 45·76	45 17 14·63
Fredericton.......	1908	0 36 18·419	"	4 26 33·564	66 38 23·46	45 57 41·30
Gateway..........	1908	0 28 39·199	Seattle...........	7 40 41·075	115 10 16·13	48 59 58·45
Guelph............	1904	0 18 10·545	Ottawa...........	5 21 00·567	80 15 08·50	43 32 43·70
Haliburton........	1909	0 11 10·911	Dom. Obs.........	5 14 02·894	78 30 43·41	45 02 43·78
Halifax............	1908	0 48 27·314	"	4 14 24·669	63 36 10·03	44 40 07·52
Harriston.........	1904	0 20 39·252	Ottawa...........	5 23 29·274	80 52 19·11	43 54 52·40
Jackfish...........	1908	0 45 01·528	Dom. Obs.........	5 47 53·511	86 58 22·66	48 47 44·84
Kalmar...........	1887	0 08 40·476	Winnipeg (old Obs)	6 19 51·154	94 57 47·31	49 46 21·96
Kamloops........	1886	1 32 47·157	Winnipeg (old Obs)	8 01 18·791	120 19 41·87	50 40 39·02
Kingston..........	1905	0 03 00·881	Dom. Obs.........	5 05 52·864	76 28 12·96	44 13 46·58
Labelle...........	1907	0 03 57·575	Dom. Obs.........	4 58 54·408	74 43 36·12	46 17 02·27
Lake Edward......	1907	0 13 45·875	"	4 49 06·108	72 16 31·62	47 39 34·25
Lindsay...........	1905	0 12 04·647	"	5 14 56·630	78 44 09·45	44 21 30·50
Liskeard..........	1906	0 15 53·001	"	5 18 44·984	79 41 14·76	47 30 33·58
Lloydminster......	1909	0 51 26·353	Winnipeg..........	7 20 01·615	110 00 24·23	53 17 08·49
Macdowall........	1909	0 35 27·580	Winnipeg..........	7 04 02·842	106 00 42·63	53 01 01·26
Madoc............	1905	0 07 01·794	Dom. Obs.........	5 09 53·777	77 28 26·66	44 30 15·70
Maniwaki.........	1906	0 01 02·581	"	5 03 54·564	75 58 38·46	46 22 28·40
Matheson.........	1908	0 18 59·665	"	5 21 51·648	80 27 54·72	48 32 07·23
Mattawa..........	1907	0 11 57·405	"	5 14 49·388	78 42 20·82	46 18 40·55

ASTRONOMICAL POSITIONS OF STATIONS—*Continued.*

Place	Year.	Difference of Longitude.	Base.	Longitude.	Longitude.	Latitude.
		h m s		h m s	° ′ ″	° ′ ″
Megantic	1908	0 19 19·926	Dom. Obs	4 43 32·057	70 53 00·85	45 34 32·80
Michipicoten	1907					47 57 40·16
Midway	1901	0 17 19·354	Vancouver	7 55 09·050	118 47 15·75	49 00 40·50
Moncton	1908	0 43 42·254	Dom. Obs	4 19 09·729	64 47 25·93	46 05 02·21
Mortlach	1910	0 35 40·810	Winnipeg	7 04 16·072	106 04 01·08	50 27 10·91
Mulgrave	1909	0 57 18·658	Dom. Obs	4 05 33·325	61 23 19·87	45 36 18·84
Newcastle	1908	0 40 33·947	Dom. Obs	4 22 18·036	65 34 30·54	47 00 11·37
Nipigon	1908	0 50 11·098	"	5 53 03·081	88 15 46·22	49 00 43·75
North Bay	1905	0 14 58·878	"	5 17 50·861	79 27 42·91	46 18 22·21
North Lake	1908	0 59 00·106	"	6 01 52·089	90 28 01·33	48 08 28·77
North Portal	1910	0 21 36·404	Winnipeg	6 50 11·666	102 32 54·99	48 59 59·37
Onion Lake	1888	0 51 26·833	Winnipeg(new Obs)	7 20 00·710	110 00 10·65	53 43 07·73
Orillia	1904	0 14 49·962	Ottawa	5 17 39·984	79 24 59·76	44 36 28·50
Ottawa	1896	0 08 31·388	Montreal	5 02 50·022	75 42 30·33	45 25 21·78
Owen Sound	1900	0 20 56·724	Ottawa	5 23 46·746	80 56 41·19	44 33 56·42
Pembroke	1907	0 05 34·875	Dom. Obs	5 08 26·858	77 06 42·87	45 49 42·15
Percé	1908	0 45 59·383	"	4 16 52·600	64 13 09·00	48 30 52·05
Pickerel	1909	0 19 15·405	"	5 22 07·388	80 31 50·82	45 58 24·05
Pincher	1910	1 07 12·020	Winnipeg	7 35 47·282	113 56 49·23	49 31 22·60
Port Arthur	1887	0 31 40·192	Winnipeg (old Obs)	5 56 51·507	89 12 52·61	48 26 01·66
Port Moody	1885	0 10 05·108	Kamloops	8 11 26·659	122 51 39·89	49 16 29·55
Portneuf	1903	0 15 15·653	Ottawa	4 47 34·369	71 53 35·53	46 42 33·44
Port Stanley	1896	0 22 00·865	"	5 24 50·887	81 12 43·30	42 39 52·73
Rainy River	1908	1 15 23·871	Dom. Obs	6 18 15·854	94 33 57·81	48 43 22·80
Rayside	1900	0 21 32·512	Ottawa	5 24 22·534	81 05 38·01	46 32 47·45
Renfrew	1905	0 03 51·729	Dom. Obs	5 06 43·712	76 40 55·68	45 28 30·08

ASTRONOMICAL POSITIONS OF STATIONS—*Continued.*

Place	Year.	Difference of Longitude.	Base.	Longitude.	Longitude.	Latitude.
		h m s		h m s	° ′ ″	° ′ ″
Revelstoke........	1886	0 08 28·970	Kamloops (1886)..	7 52 49·847	118 12 27·70	51 00 11·25
Rivière-à-Pierre...	1907	0 14 08·284	Dom. Obs........	4 48 43·699	72 10 55·48	46 59 16·90
Rivière-du-Loup...	1908	0 24 45·836	"	4 38 06·147	69 31 32·20	47 49 23·48
Rivière Ouelle.....	1906	0 22 46·239	"	4 40 05·744	70 01 26·16	47 29 04·86
Roberval..........	1907	0 13 57·797	"	4 48 54·186	72 13 32·79	48 31 03·68
Rose Point........	1900	0 17 19·911	Ottawa.........	5 20 09·933	80 02 28·99	45 19 00·73
Sault Ste. Marie...	1910	0 34 26·815	Dom. Obs.........	5 37 18·798	84 19 41·97	46 30 31·37
Scotia Junction....	1907	0 14 18·831	"	5 17 10·814	79 17 42·21	45 30 46·75
Selkirk............	1907	0 08 13·294	Dawson...........	9 09 30·605	137 22 39·08	62 46 20·98
Sharbot Lake.....	1905	0 03 53·937	Dom. Obs........	5 06 45·920	76 41 28·80	44 46 29·07
Shippigan.........	1909	0 44 00·423	"	4 18 51·560	64 42 53·40	47 44 38·62
Sorel..............	1908	0 10 24·308	"	4 52 27·675	73 06·55·12	46 02 19·59
Sprague...........	1908	1 19 41·368	"	6 22 33·351	95 38 20·26	49 02 05·10
Ste. Anne-de-Bellevue........	1905	0 07 03·752	"	4 55 48·231	73 57 03·46	45 24 28·13
St. Catharines.....	1905	0 14 05·012	"	5 16 56·995	79 14 14·92	43 09 41·72
St. Hyacinthe.....	1908	0 11 07·658	"	4 51 44·325	72 56 04·87	45 37 15·28
St. Jerome........	1908	0 06 52·184	"	4 55 59·799	73 59 56·98	45 46 33·29
St. John...........	1908	0 38 35·985	"	4 24 15·998	66 03 59·97	45 16 35·04
Stonyplain........	1909	1 07 26·573	Winnipeg.........	7 36 01·835	114 00 27·53	53 31 47·27
Sutton............	1905	0 14 35·633	Dom. Obs.........	5 17 27·616	79 21 54·24	44 18 12·49
Sydney............	1909	1 02 04·431	"	4 00 47·552	60 11 53·28	46 08 27·86
Tadoussac.........	1905	0 24 00·532	Dom. Obs........	4 38 51·451	69 42 51·76	48 08 27·19
Tantalus.........	1907	0 12 35·313	Dawson....... ..	9 05 08·586	136 17 08·79	62 05 28·56
Three Rivers......	1902	0 12 41·407	Ottawa...........	4 50 08·615	72 32 09·22	46 20 37·09
Timagami.........	1905	0 16 17·318	Dom. Obs.........	5 19 09·301	79 47 19·51	47 03 47·91
Trenton...........	1905	0 07 26·720	"	5 10 18·703	77 34 40·54	44 05 52·53
Truro.............	1908	0 49 46·955	"	4 13 05·028	63 16 15·42	45 21 47·32

ASTRONOMICAL POSITIONS OF STATIONS—*Concluded.*

PLACE	Year.	Difference of Longitude.	Base.	Longitude.	Longitude.	Latitude.
		h m s		h m s	° ′ ″	° ′ ″
Vancouver........	1905	0 03 08·130	Seattle..........	8 12 28·404	123 07 06·06	49 17 46·07
Victoria..........	1885	0 04 06·994	"	8 13 26·444	123 21 36·66	48 25 31·38
Walsh............	1910	0 51 34·290	Winnipeg.........	7 20 09·552	110 02 23·28	49 57 06·79
Wapella..........	1887	0 19 21·505	Winnipeg(old Obs)	6 47 53·097	101 58 16·46	50 15 45·79
Whitby...........	1905	0 12 53·864	Dom. Obs........	5 15 45·847	78 56 27·70	43 52 43·34
Whitehorse........	1907	0 17 32·318	Dawson..........	9 00 11·581	135 02 53·71	60 43 17·17
White Pass........	1907	0 17 10·389	"	9 00 33·510	135 08 22·65	59 37 28·66
White River.......	1902	0 38 17·627	Ottawa..........	5 41 07·649	85 16 54·73	48 35 11·53
Wilno............	1900	0 07 24·676	"	5 10 14·698	77 33 40·47	45 30 54·46
Windsor..........	1910	0 29 19·499	Dom. Obs........	5 32 11·482	83 02 52·23	42 18 58·31
Winnipeg..........	1910	1 25 43·279	"	6 28 35·262	97 08 48·93	49 53 10·98
Woodstock (Ont.).	1903	0 20 14·841	Ottawa..........	5 23 04·863	80 46 12·94	43 08 07·62
Woodstock (N.B.).	1908	0 32 32·979	Dom. Obs........	4 30 19·004	67 34 45·06	46 08 33·28
Yarmouth.........	1909	0 38 23·205	Dom. Obs........	4 24 28·778	66 07 11·67	43 50 14·75

LOCAL POSITIONS OF ASTRONOMICAL STATIONS.

Bancroft.—The pier is 99.8 feet west and 220.8 feet north of the centre point of the crossing of Station street and the Central Ontario railway.

Barry Bay.—The pier is about 200 feet south of the Grand Trunk railway station-house and is 106.9 feet south and 1.1 feet east of the northeast corner of the Balmoral hotel.

Bathurst.—The pier is 54.1 feet west and 79.2 feet north of the southeast corner of King and Water streets, town of Bathurst.

Beeton.—The astronomical station is 100 feet west of the west side of Patterson street and 78 feet north of the north side of Main street. Patterson street is a road allowance between lots 10 and 11. Main street is a road allowance between concessions 7 and 8 in the township of Tecumseth.

Black Lake.—The pier is 111.1 feet east and 190.8 feet north of the northwest corner of Whitney avenue and the private way of the American Asbestos Company.

Boiestown.—The pier is 41.63 feet east and 90.87 feet north from the northeast corner of T. Lynch & Co.'s supply store.

Boundary (Yukon).—The astronomical station is on the south bank of the Yukon river and is 352 feet east of the "Ogilvie Line" and about 20 feet south from the shore of the Yukon river.

Boundary (Waneta).—The pier is 24.5 feet due east of monument No. 181 on the international boundary line.

Calgary.—The astronomical station is 1 chain 56 links south of the centre line of the main line of the Canadian Pacific railway, and 2 chains 49 links north of the northeast corner of town lot No. 11 in block 69. The meridian through the observatory passes $37\frac{1}{2}$ links east of said northeast corner of lot 11.

Campbellton.—The pier is 18.27 feet east and 12.41 feet south of the southeast corner of the post office building.

Canoe Lake.—The astronomical station is 371 feet due south of the centre line of the Ottawa and Parry Sound railway, 526 feet due west from the division line between lots Nos. 20 and 21 in the 14th concession in the township of Peck.

Chalk River.—The astronomical station is on a slight knoll on the sandy expanse south of the Canadian Pacific railway track and distant 1885.7 feet on a course south 56° 15′ east from the original post on the north side of the road allowance between concessions 8 and 9 and between lots 1 and 2 in the township of Buchanan; it is also distant 457.6 feet due south from the centre line of the main line of the Canadian Pacific railway. It may be mentioned that the old or first Canadian Pacific railway station was considerably east (several miles) of the present one.

Chapleau.—The pier is 174.7 feet west and 432.3 feet south of the railway crossing sign-board of the Canadian Pacific railway. This crossing is about 300 feet west of the Canadian Pacific railway station-house.

Charlottetown.—The pier is situated off Water street 94.13 feet south and 19.73 feet west of the northwest corner of the stone verandah of Richard Grant's house.

LOCAL POSITIONS OF ASTRONOMICAL STATIONS—*Continued.*

Cobourg.—The astronomical station is situated 63 feet north of University avenue, 243 feet east of the east side of College street produced northerly, and 81 feet 6 inches due south of the centre of the dome of Faraday Hall.

Cochrane.—The pier is 24.8 feet west and 173.6 feet north of the southeast corner of Second street and Third avenue, town of Cochrane.

Coutts.—The pier is 5803.8 feet south and 3514.9 feet east of triangulation station "Tenant," of the International Boundary Survey.

Covey Hill.—The astronomical station is situated on township lot 34 in range 1 of the township of Havelock; owned by Mr. John Waddell. The station is marked by an iron bolt in the solid rock, two feet below the surface, over which a cairn of stones was erected. The azimuth to monument 684 on the international boundary is 135° 07′, and the distance 7716.4 feet. It is on the highest part of Covey Hill.

Dawson.—The pier is 168.3 feet east and 7.1 feet north of the southeast corner of the Administration Building.

Digby.—The pier is 7.03 feet south and 183.44 feet east of the stone foundation of the northeast corner of the entrance to the schoolroom of the Baptist church.

Dominion Observatory.—The meridian to which the longitudes are referred is that of the meridian circle in the transit annex.

Edmonton.—Here it was intended to occupy the Dominion Lands Survey latitude station (King) of 1877, but that being impracticable on account of excavation made there, the situation was established (observatory building) 70.2 feet south-east thereof, the azimuth being 120°.07. The 14th base line (Aldous, 1879) intersects the meridian of astronomical station (King, 1877) at 298.45 chains west of the northeast corner of township 52, range 24, west of the Fourth meridian (old system).

Edmundston.—The pier is 148.30 feet east and 12.04 feet north of the northeast corner of the Temiscouata railway station.

Emerson.—The pier is 1135.0 feet south and 43.5 feet east of the southeasterly corner of Morris and Second streets in the town of Emerson; also 411.3 feet due north of the international boundary line. The azimuth station is about one and one-half miles due south of the observatory; it is situated midway between Mr. Moise Pranteau's granary and implement house.

Erwood.—The pier is 729.5 feet north and 3035.1 feet west of iron post at northerly corner between sections 1 and 2, township 45, range 2, west of the 2nd meridian.

Father Point.—The astronomical station is on the property of J. McWilliams, immediately adjoining the lighthouse reserve. The centre of the pier is 125 feet 7 inches due south of the centre of the revolving light surmounting the lighthouse.

Field.—The astronomical station is situated on the north side of the Canadian Pacific railway track near and west of the Canadian Pacific railway hotel then building. It is distant 68 feet 8 inches from Canadian Pacific railway traverse station No. 93 in the year 1886.

LOCAL POSITIONS OF ASTRONOMICAL STATIONS—*Continued.*

Fort Frances.—The pier is 9.7 feet north and 189.2 feet east of the northeast corner of Fourth street and Cornwall avenue.

Foster.—The pier is 181.5 feet north and 480.3 feet west of the middle point of the crossing of the Bolton road and the Canadian Pacific railway main line (Foster crossing). The pier is about 80 feet north of the Canadian Pacific railway station-house.

Fredericton.—The pier is on the river front 52.15 feet north and 67.0 feet west of the northwest corner of Lamont's furniture warehouse at the corner of Regent and Campbell streets.

Gateway.—The pier is on the international boundary line 189.4 feet due east of boundary monument No. 244, and is 541.3 feet west of United States survey post No. 25104 on boundary line.

Guelph.—The astronomical station is 150 feet west of Norfolk street and 85 feet north of Paisley street, Nelson crescent.

Haliburton.—The pier is 22.0 feet north and 32.9 feet west of the southwest corner of lot 3, block L, north side of Queen street, village of Haliburton.

Halifax.—The pier is 127.26 feet east and 90.38 feet north of the southeast corner of Creighton & Co.'s grocery store. It is also 63.23 feet east and 54.04 feet south of the gas pipe marking the boundary of the I.C.R. yard. Direction of said pipe from pier being 54° 15′ from the meridian measured from the north through the west.

Harriston.—The astronomical station is 108 feet south of Queen street, and 148 feet east of Union street.

Jackfish.—The pier is 228.5 feet north and 82.9 feet west of the southwest corner of the Canadian Pacific railway station-house.

Kalmar.—The position of astronomical station is on the sloping hillside west of the railway station, since rebuilt, and on the north side of the Canadian Pacific railway due north 88 feet 5½ inches from the centre line thereof.

Kamloops.—The astronomical station is on the intersection of the middle lines of Victoria avenue and Fifth street of the new townsite.

Kingston.—The observatory is situated on the Royal Military College grounds on Point Frederick, about 200 feet from Cataraqui bay. It is used in connection with the work of the college.

Labelle.—The pier is 1685 feet east and 82 feet south of the middle point of crossing of the Canadian Pacific railway and Berthiaume road. This crossing is about 470 feet east of the Canadian Pacific railway station-house.

Lake Edward.—The pier is 332.4 feet east and 40.6 feet north of the northeast corner of the Quebec and Lake St. John railway station-house.

LOCAL POSITIONS OF ASTRONOMICAL STATIONS—*Continued.*

Lindsay.—The astronomical station is on the right-of-way of the Canadian Pacific railway, 10.7 feet west and 172.8 feet north of the northwest corner of the Canadian Pacific railway station-house.

Liskeard.—The observatory pier is 25.5 feet south and 836.6 feet west of an iron post which is 145 feet S. 5° 20′ W. of the southwest corner of the Timiskaming and Northern Ontario railway station-house.

Lloydminster.—The pier is 378.0 feet west and 2455.1 feet north of the northeast corner of section 36, township 49, range 1, west of the 4th meridian.

Macdowall.—The pier is 2365.9 feet south and 1986.8 feet west of the northeast corner of section 13, township 46, range 1, west of the 3rd meridian.

Madoc.—The pier is 113 feet west and 123 feet north of the northwest corner of Durham and St. Lawrence streets.

Maniwaki.—The observatory pier is 112.8 feet south and 69.8 feet west of the southwest corner of the Canadian Pacific railway station-house.

Matheson.—The pier is on the right-of-way of the Timiskaming and Northern Ontario railway, and is 153.5 feet south and 178.0 feet east of the northeast corner of Fifth avenue and Railway street.

Mattawa.—The pier is 419.6 feet west and 56.2 feet south of the southwest corner of the Canadian Pacific railway station-house.

Megantic.—The pier is 172.5 feet east and 72.6 feet north of the southwest corner of Maple avenue and McCauley street.

Michipicoten.—The pier is 45 feet north and 104 feet west of the northwest corner of the Algoma Inn.

Midway.—The astronomical station is situated about 100 feet south of the Canadian Pacific railway station (dwelling and ticket office) and 607½ feet in azimuth 255° 37′ from the point on the east side of Adams street, 15⅓ feet south of the south side of Eleventh street.

Moncton.—Reference point is the northwest corner of the Intercolonial railway blacksmith shop N. 52° 16′ E. from meridian through centre of pier. Distance 4.378 chains.

Mortlach.—The pier is 1144.7 feet south and 3583.2 feet west of the northeast corner of section 22, township 17, range 1, west of the 3rd meridian.

Mulgrave.—The pier is situated 40.51 feet north and 60.59 feet west of the northwest corner of Mr. Kawaga's house.

Newcastle.—The pier is 14.16 feet east and 90.66 feet south of the intersection of Station and Gene streets.

Nipigon.—The pier is 47.8 feet west and 82.4 feet north of the northwest corner of the Canadian Pacific railway station-house.

North Bay.—The astronomical station is situated on the property of the Canadian Pacific railway. The pier is 283.5 feet south and 109.5 feet west of the northwest corner of Main and Sherbrooke streets.

LOCAL POSITIONS OF ASTRONOMICAL STATIONS—*Continued.*

North Lake.—The pier is 272.5 feet east and 15.5 feet south of "frog" lying between the Port Arthur and Duluth railway main line and the southwest leg of the "Y".

North Portal.—The pier is 33.6 feet east and 0.7 feet north of the boundary monument situated on the international boundary line between the villages of Portal, N.D., and North Portal, Sask. The azimuth pier is due north of the observatory pier a distance of about one-half mile.

Onion Lake.—The astronomical station is situated 4 chains in azimuth 95°.81 from the point on survey line of Fourth meridian, 19.685 chains north of the southeast corner of township 55, and 3 feet south of the government telegraph line (the wire running over the observatory).

Orillia.—The astronomical station is 174½ feet south of Mississaga street, and 87½ feet east of Peter street.

Ottawa.—The observatory is at the northerly end of lot No. 7 on the north side of Cliff street, and at the edge of the perpendicular cliff overlooking the Ottawa river.

Owen Sound.—The astronomical station is distant southwesterly 215.96 feet on the course making an angle of 57° 33′ with the westerly side of Poulett street from the intersection of that side of Poulett street with the southerly side of Baker street.

Pembroke.—The pier is 98.2 feet north and 167.5 feet east of the intersection of the easterly limit of John street with the southerly limit of Wellington street.

Percé.—The pier is 84.63 feet west and 72.28 feet south of the southwest corner of Abraham Lenfesty's house.

Pickerel.—The pier is on a rocky knoll south of the Canadian Pacific railway main line and nearly opposite the station. The centre of the pier is 90.8 feet south and 60.1 feet east of the southeast corner of the Canadian Pacific railway station-house.

Pincher.—The pier is 555.0 feet south and 14.0 feet west of the northeast corner of section 34, township 6, range 30, west of the 4th meridian.

Port Arthur.—The pier is 77.6 feet north and 48.2 feet east of the northwest corner of Arthur street and South Water street.

Port Moody.—The astronomical station is 80 feet south of the centre line of the Canadian Pacific railway, 28 feet 10 inches southwest from a lot-stake marked L.18, and 25 feet 6 inches west from the centre of the plank road leading across the railway to the Elgin hotel.

Portneuf.—The astronomical station is 21,667.11 feet in azimuth 298° 40′ 54″.3 or N. 61° 19′ 05″.7 W. from monument No. 31 of the St. Lawrence River Survey.

Port Stanley.—The position of the astronomical station is on the property known formerly as a "Ship-yard" lying along the east side of Kettle creek, and to the west side of lots 1, 2 and 3 fronting on the west side of Main street.

LOCAL POSITIONS OF ASTRONOMICAL STATIONS—*Continued.*

Rainy River.—The pier is 111.2 feet north and 51.3 feet west of the southwest corner of Third street and Atwood avenue.

Rayside.—The astronomical station is situated on the farm of John Carrière, on lot 3, concession 1, township of Rayside, and distant 605.8 feet west from the division line between lots 2 and 3, and 441.4 feet north of the centre line of the Canadian Pacific railway.

Renfrew.—The astronomical station is situated north of the Canadian Pacific railway station, about 210 feet north of the main line. The pier is 75 feet north and 77.7 feet east of the southwest corner of Joe and Janet streets.

Revelstoke.—The astronomical station is 134 feet 10 inches to the north of the centre line of the Canadian Pacific railway, and 128 feet 8 inches on a course north 37° 29′ east from Canadian Pacific railway traverse station No. 1064 of the year 1886.

Rivière-à-Pierre.—The pier is 120.2 feet west and 39.3 feet north of the northwest corner of the Quebec and Lake St. John railway station-house.

Rivière-du-Loup.—The pier is 511.5 feet from the southeast corner of the I. C. R. machine shop. Angle from the north through the west 41° 54′.

Rivière Ouelle.—The observatory pier is 18.7 feet south and 180.3 feet east of the first mooring post on the east side of the wharf. It is also about 70 feet from the Intercolonial railway crossing at the end of the wharf.

Roberval.—The pier is 138.2 feet north and 47.1 feet west of the middle point of crossing of the Quebec and Lake St. John railway and the Roberval road.

Rose Point.—The point of observation is on the north side of the railway track in the southeast corner of the garden of the Rose Point hotel, and 50 feet east of the road leading to the village of Parry Harbour. It is distant 196 feet at right angles to the township lot line running N. 20° 51′ 40″ W. (Beatty) at the point distant along the lot line 693 feet from the centre line of the Ottawa and Parry Sound railway.

Sault Ste. Marie.—The pier is 51.78 feet south of the southwest corner of Queen street and Bell avenue.

Scotia Junction.—The pier is about one-half mile east of the Grand Trunk railway station-house and is 249.4 feet north and 7.5 feet east of the sign-post at the Grand Trunk railway crossing.

Selkirk.—The pier is 32 feet east and 22.5 feet south of the northeast corner of the Government Telegraph office.

Sharbot Lake.—The astronomical station is on a hill north of the Canadian Pacific railway station. The pier is 385 feet north and 73.5 feet west of the west corner of the Canadian Pacific railway station-house.

Shippigan.—The pier is 309.3 feet south and 2643.1 feet west of the southwest corner of the shore end of the curb lying on the west side of Shippigan wharf. It is also 793.1 feet south and 1041.4 feet west of the main spire of the Roman Catholic church.

LOCAL POSITIONS OF ASTRONOMICAL STATIONS—*Continued.*

Sorel.—The pier is 194.9 feet west and 34.2 feet north of the southeast corner of Ray and Victoria streets.

Sprague.—The pier is 670.7 feet west and 1.4 feet north of the southwest corner of the Canadian Northern railway station-house.

Ste. Anne-de-Bellevue.—The astronomical station is about 300 feet south of the Canadian Pacific railway station. The pier is 1552.22 feet N. 12° 12′ 15″ E. from main triangulation station 5 on end of guard pier at the lower entrance of the new lock.

St. Catharines.—The astronomical station is situated on the property of the St. Catharines Gas Company at the corner of Phelps and Mill streets. The pier is 191.5 feet north and 94 feet east of the northeast corner of Phelps and Mill streets.

St. Hyacinthe.—The pier is 85 feet east and 546 feet north of the middle point of the crossing of Broadway road and the Canadian Pacific railway main line, and is about 400 feet from the station-house.

St. Jerome.—The pier is 412.0 feet east and 102.4 feet south of the southeast corner of St. Antoine and St. Anne streets. It is on the Canadian Pacific railway right-of-way about 400 feet south of the station-house.

St. John.—The pier is 82 feet north and 174 feet west of the northeast corner of Lombard and Southwork streets. Reference point is southeast corner of I.C.R. grain elevator. Reference angle 188°.44 right from meridian at centre of pier to reference point. Distance 196.8 feet.

Stonyplain.—The pier is 4102.6 feet south and 1197.8 feet west of iron post at the northeast corner of section 36, township 52, range 1, west of the 5th meridian.

Sutton.—The astronomical station is situated on the right-of-way of the Grand Trunk railway. The pier is 65.7 feet south and 111.2 feet west of the southwest corner of the Grand Trunk railway station-house.

Sydney.—The pier is on the esplanade 49.24 feet south and 89.66 feet west of the northwest corner of the Sydney hotel.

Tadoussac.—The astronomical station is on the premises of the Richelieu and Ontario Navigation Company, to the rear of their hotel. The meridian through the centre of the pier passes one foot west of the flag-pole over the tower of the main or office entrance to the hotel, and the flag-pole is 211 feet south of the pier.

Tantalus.—The pier is 150.8 feet north and 32 feet west of the northwest corner of the Northwest Mounted Police barracks.

Three Rivers.—Astronomical station at Station No. IX. of the St. Lawrence River Hydrographic Survey.

Timagami.—The astronomical station is situated on the right-of-way of the Timiskaming and Northern Ontario railway. The pier is 316 feet south and 219.6 feet west of the southwest corner of the Timiskaming and Northern Ontario railway station-house.

LOCAL POSITIONS OF ASTRONOMICAL STATIONS—*Concluded.*

Trenton.—The astronomical station is on the right-of-way of the Central Ontario railway. The pier is 173 feet south and 83 feet east of the southeast corner of the Central Ontario railway station-house.

Truro.—The pier is 49.49 feet east and 64.13 feet south of gas pipe marking the boundary of the I.C.R. yard at head of Miller street and at the hinge end of Mr. Fraser's driveway gate.

Vancouver.—A permanent observatory was built on Brockton Point close to and southeast of the lighthouse.

Victoria.—The astronomical station is situated 7 feet 5 inches east of Broad street and 17 feet 6 inches south of View street, being in the northwest corner of the garden of the Driard hotel.

P.S.—Subsequently the hotel was extended to Broad street.

Walsh.—The pier is 1128.9 feet south and 2896.5 feet west of the wooden post marking the northeast corner of the southeast quarter of section 35, township 11, range 1, west of the 4th meridian.

Wapella.—The position of the astronomical station is on a knoll south of the Canadian Pacific railway and 5 chains 85 links southwesterly from the southwest corner of the railway station. It is definitely fixed by triangulation from the second meridian of the Dominion Lands survey.

Whitby.—The pier is 198 feet north and 159.3 feet east of the northeast corner of Brock and Colborne streets.

Whitehorse.—The pier is just behind the Government Telegraph office, and is 336.1 feet north and 379.7 feet west of the middle point of crossing of Main street and the White Pass and Yukon railway.

White Pass.—The pier is 111.1 feet north and 45.9 feet west of the bronze monument on the Canada-Alaska boundary line at summit of White Pass.

White River.—The astronomical station is on the sandy ridge south of the railway station, and distant 98½ feet due east of the centre line of the main track of the Canadian Pacific railway, from the point distant 183 feet north along the track from the "east switch," where the White River railway division begins.

Wilno.—The astronomical station is 766 feet due north of the centre line of the Ottawa and Parry Sound railway and 653 feet on a course N. 73° 38′ W. from the intersection of the lines separating the 4th and 5th concessions of the townships of Sherwood and Hagarty.

Windsor.—The pier is 33.3 feet east and 246.8 feet south of the southwest corner of Sandwich street west and Caron avenue in the city of Windsor.

Winnipeg.—The pier is on the Fort Osborne barracks ground near the southwest corner of the drill hall.

Woodstock, Ont.—The astronomical station is situated within the city limits of Woodstock, on land owned by the corporation on the north side of Admiral street, 21 feet west of the produced westerly limit of Givins street. It is marked by a concrete pier.

Woodstock, N.B.—The pier is 432.5 feet east and 100 feet south of the northeast corner of George and Main streets.

Yarmouth.—The pier is on Mr. Jacob Bingie's vacant lot, corner of Water and Townsend streets, 258.96 feet west and 64.78 feet north of the stone post at the southwest corner of Mr. James Lovett's property corner of Main and Townsend streets.

MAP
DOMINION OF CANADA
SHEWING
ASTRONOMICAL STATIONS
HUDSON BAY
LABRADOR
MANITOBA
SASKATCHEWAN
Cochrane
Winnipeg
Emerson
Sault Ste Marie
North Portal
Halifax
Yarmouth
Dawson

APPENDIX 5.

REPORT OF THE CHIEF ASTRONOMER, 1911.

STATEMENT OF WORK PERFORMED IN THE PHOTOGRAPHIC DIVISION.

BY

J. D. WALLIS.

APPENDIX 5.

STATEMENT OF WORK DONE IN THE PHOTOGRAPHIC DIVISION.

SIZES	4¼″ x 6½″	5″ x 7″	8″ x 10″	5″ x 14″	11″ x 14″	16″ x 20″	20″ x 24″	24″ x 36″	30″ x 40″	40″ x 60″	9″ x 36″	Total
Negatives.....	664	152	470	45	63	51	....	....	....	....	....	1445
Prints........	....	1586	498	193	580	217	45	23	51	27	383	3603
Total.....	664	1738	968	238	643	268	45	23	51	27	383	5048

J. D. WALLIS,
Photographer.